Memorandum

To: Honorable Mayor John Leahy and Members of the Lowell School Committee
From: Dr. Joel D. Boyd, Superintendent of Schools
Date: March 12, 2021
RE: Expansion of In-Person Learning

Overview
On March 5, 2021, the Massachusetts Board of Elementary and Secondary Education voted to authorize the Commissioner to unilaterally determine whether hybrid and remote learning models will continue to be approved as structured learning time for students and when those models will no longer count towards the legally required 170 days of school for SY2020-2021. The Commissioner subsequently released guidance to school districts which removed hybrid and remote learning models from counting as learning time for elementary aged students (grades K to 5) as of April 5 and middle grades (6 to 8) as of April 28, 2021, and stated that all school districts in the Commonwealth are now required to allow all students in those grade levels to return to school full-time, five days per week, unless their parents opt for remote learning.

This memo outlines the recommended phased expansion of in-person learning in Lowell Public Schools (LPS) within this newly re-defined legal context. This addendum to the District's reopening plan will (1) expand full-time, in-person learning for grades K to 5 on April 5th and grades 6 to 8 on April 26th, aligning our local instructional model with the new statewide requirements that were provided by the Department of Elementary and Secondary Education (DESE), and (2) establish an instructional model and target date of April 26th to also expand in-person learning for grades 9 to 12 pending future guidance from DESE.

Updated DESE Guidance on Structured Learning Time
The full DESE guidance document with revised requirements for structured learning time and in-person learning that was released on March 9, 2021 is attached (see Appendix A). Of important note for the Committee are the following passages which significantly differentiate this document from previous guidance documents provided by DESE:

- *These regulations are legally binding. Any district that does not comply with the regulatory requirements or receive a waiver by April 5, 2021 (for the elementary school phase of the plan) will be required to make up any missed structured learning time. This time could be made up during this school year, over the summer, or into next school year if necessary. In addition, G.L. c. 71, § 4A links Chapter 70 funds to structured learning time.*
- *Because the regulations have the force of law, once the Commissioner makes the determination that hybrid and remote learning will no longer count towards structured learning time, a school committee vote on which learning model to adopt is not necessary because full-time, in-person learning will be the default required model. Remote learning should be provided only if parents/guardians opt out of in-person learning for the remainder of this school year and for students who must remain home due to a COVID-19 related issue.*

While continuing to allow all families the option of full-time remote learning, the Commissioner released the following timeline for school re-opening to which all school districts in the

Commonwealth are now required to adhere unless a formal request for a waiver is submitted to DESE and approved by the Commissioner:

- ***Elementary school phase (grades K-5):*** *Districts and schools are required to shift their learning model for elementary school grade levels to full-time, in-person instruction five days per week effective* ***Monday, April 5, 2021.***
- ***Middle school phase (grades 6-8):*** *Districts and schools will be required to shift their learning model for middle school grade levels to full-time, in-person instruction five days per week, effective* ***Wednesday, April 28, 2021.*** *Districts may choose to ask students who have traveled to a state on the restricted list to learn remotely for the week of April 26, 2021 (the week after April vacation).*
- ***High school phase (grades 9-12): [DESE] will announce the details and timing of the high school phase of the plan in April.*** *Districts will be provided with at least two weeks advance notice of the specific date requirement for high school students but should start making such plans now.*

Recommended Phased Expansion of In-Person Learning

The significant prior planning in anticipation of an April expansion of in-person learning as adopted by the School Committee on February 22 has positioned LPS well for implementing the new legal requirements for structured learning time, with a few adjustments at each grade span as noted below. Most significantly, since a hybrid learning model is no longer legally allowable at grades K to 8, that option has been removed from our planning considerations at those grade levels. Likewise, based on feedback from multiple stakeholders, it's recommended that our local timeline of expanding in-person learning shifts to a phased approach in accordance with DESE's requirements - grades K to 5 expansion will begin on April 5th and grades 6 to 12 expansion will begin on April 26th following the spring break.

Elementary School

April 5th - Return to 5 days per week of in-person learning for students who have been fully remote since the beginning of the school year with a parental option for students to remain fully remote. The concurrent/simultaneous instructional model will support both in-person and remote learners to maximize stability and continuity in class rosters and teacher-student relationships as much as possible. Computer cameras have been purchased and distributed to schools for all returning teachers to support a concurrent/simultaneous instructional model. Network server points in elementary schools have been evaluated by the Information Technology (IT) Department to ensure school wifi is ready to support the instructional models, and teachers will be able to successfully use the hardware and software needed for the concurrent/simultaneous learning model. All elementary schools will operate with the goal of having as minimal a disruption to the learning environment as possible for the students who are part of the 25% in-person model and returned to school on March 1. However, in certain circumstances, adjustments to class sizes may be unavoidable based on in-person demand and space availability.

Middle School

April 5th - Grade 5 students, who have been fully remote since the beginning of the school year, will return to 5 days per week of in-person learning with a parental option for students to remain fully remote. As in the elementary school model, concurrent/simultaneous teaching will support both in-person and remote learners to maximize stability and continuity in class rosters and teacher-student relationships as much as possible. As the entering grade for middle school, April 5th

will be the first time these 5th graders will have been on the middle school campus. And this phased approach at middle school of starting with only 5th graders on April 5th - in addition to aligning more closely with DESE's requirements - will allow younger students to have the added benefit of coming on to campus first and becoming familiar with the school facilities with only a small population of in-person learners present.

April 26th (*this date differs slightly from the middle school date of April 28th in the DESE guidance document due to the District's return from spring break*) - Grades 6 to 8 students, who have been fully remote since the beginning of the school year, will return to 5 days per week of in-person instruction with a parental option of full remote. Again, as with the other grade levels, the concurrent/simultaneous instructional model will support both in-person and remote learners. Computer cameras have been purchased and distributed to schools for all returning teachers to support the concurrent/simultaneous instructional model. Network server points in the middle schools have been evaluated by the IT Department to ensure school wifi is ready to support instruction, and staff will be able to successfully use the hardware and software needed for the concurrent/simultaneous learning model. Middle schools will also operate with the goal of as minimal a disruption as possible for the students who are part of the 25% in-person model and returned to school on March 1. However, as in the elementary school model, in certain circumstances, adjustments to class sizes may be unavoidable based on in-person demand and space availability.

High School

April 26th - As we await further regulatory guidance from DESE regarding high school, to accommodate the unique challenges of population size and rostering continuity at Lowell High (LHS), the District is continuing to plan for a hybrid instructional model - to begin after spring break for grades 9-12 - utilizing a daily rotating or cascading schedule with noon dismissal for students who have been fully remote since the beginning of the year, while continuing to offer a parental option of full remote for all students. Similar to other schools, computer cameras have been purchased and distributed to LHS for all returning teachers. Network server points located in the high school have also been evaluated by the IT Department to ensure school wifi is ready to support the instructional models to include live streaming. The LHS administrative team is currently exploring the most effective use of the cameras instructionally at the high school level, and they are planning to support LHS teachers with hardware implementation through professional development that is specific to departmental content.

Professional Development for Instructional Staff

As discussed at prior School Committee meetings, concurrent/simultaneous teaching of in-person and remote learners presents obvious challenges and creates a less-than-optimal instructional environment. The elimination of the rotating cohort, hybrid model in grades K-8 will alleviate some scheduling concerns that have been shared by educators, but with DESE's requirement that full-time remote learning remain as an option for our families through the end of the school year, **concurrent/simultaneous teaching will still be required across the majority of classrooms in LPS**. Thus, the professional development plan that has been in development to support teachers and school-based instructional staff based on the Committee's previously approved target date of April 1st for expanding in-person learning remains relevant and will proceed accordingly.

The Office of Teaching and Learning will be offering all school-based staff - who are assigned to a classroom that requires concurrent/simultaneous teaching - professional development in an EdCamp format where participants may select sessions specifically to meet individual teaching and learning

needs. Up to 6 hours of professional development will be available to all staff members prior to April 5th to support them in navigating the concurrent/simultaneous instructional model. Appendix B provides the professional development sessions that will be offered Monday through Thursday, March 22-25, from 3:30PM-5:30PM, and Saturday, March 20, from 9AM-1PM. Following the current provisions of our Collective Bargaining Agreement with UTL, all sessions will be optional and staff will be compensated at the per diem rate for 6 hours of participation as the sessions will be offered outside of the contractual work day to avoid disruptions to the current remote learning environment.

Social Distancing in Classrooms

The new legal requirements established by DESE for in-person learning significantly shifts how social distancing in LPS classrooms will be measured going forward. Previously, based on our original re-opening plan that the Committee adopted in August, social distancing was set at a minimum of 6 feet for all students and staff and in-person class sizes were determined based on how many students could fit within a given space while maintaining that level of physical separation. On April 5th, **social distancing requirements will change to a minimum of 3 feet** and all students who choose to return to in-person learning will be provided with access to the classroom environment.

Within its guidance documents and related public forums, DESE has cited the growing body of literature that has found no difference between 3 feet and 6 feet of social distancing in terms of viral transmission when masks are worn by all parties (see Appendix C). Nevertheless, this shift in social distancing has caused some understandable anxiety among educators given the limited access the public has had to review and understand this new research base. Recognizing these concerns, **building principals are currently researching all spaces available within school buildings to determine the maximum level of social distancing that can be provided within each specific classroom space**. Where possible, leaders are working to provide 6 feet of distance between student desks from chair to chair, but this will not be possible in all cases based on the increasing demand for in-person seats and the available classroom spaces. All non-educational spaces, that may provide 6 feet of distancing, will be reviewed as possible alternative educational spaces, but in some cases, classes will have to lower social distancing between students to 5 feet, 4 feet or 3 feet. Based on school leaders' initial analysis, six schools estimate 6 feet is possible, seven schools estimate at least 5 feet is possible, three schools estimate between 4-6 feet is possible, depending on the classroom space, and six schools may have to utilize 3 feet of social distancing between student desks. Teachers' desks will remain at 6 feet of distance from students' desks. The therapeutic day schools were not included in the results above, because the therapeutic day schools returned on February 22, 2021. Due to the uniqueness of the campus, Lowell High School will need to further analyze the facilities.

It's important to also note that with the continued prevalence and severity of COVID-19, LPS has added additional protective measures for members of our school communities over and beyond social distancing, the requirement of masks and personal hygiene. COVID-19 pool testing is now available and will continue to be provided in all schools for the duration of this academic year and air purifiers will be installed in all classrooms to which large groups of students are assigned. In addition, although vaccines are not currently viewed by public health experts as necessary for school reopening and the vaccine is not considered as a requirement by DESE, the District is continuing to work collaboratively with vaccine providers to advocate for accelerated and prioritized access to the vaccine for all school district employees.

Transportation for Students

School bus transportation with reduced rider capacity has and will continue to present a significant challenge for every school district within the COVID-19 environment, including LPS, and has created a true hardship for our families who rely on the school bus as their only means of transportation to and from school.

Out of necessity for student safety, in August, 2020, the School Committee approved a temporary adjustment to the District's transportation policy for the current academic year, aligning our local bus capacity limits with the recommendations of the Center for Disease Control (CDC) and DESE at that time, which equated to approximately one-third of the District's standard rider capacity. To objectively reduce capacity, prior to the start of the school year, bus transportation eligibility was narrowed to include only students who were legally entitled to yellow bus transportation based on MA law, including students in grades 1 to 6 who reside outside of a 2 mile radius from their school.

On February 11, 2021, DESE lifted many of the restrictions on transportation capacity through updated guidance. With that revised guidance and the planned expansion of in-person learning on April 5, 2021, the District's Transportation Department has been actively researching options to safely increase access to bus transportation for as many families as possible. However, at the present time, the Transportation Department has identified other factors beyond DESE's guidance - primarily the availability of bus drivers to support increased bus routes - which limit the possibility for the District to reliably implement an increase to bus capacity immediately. Consequently, for at least the first phase of expanded reopening on April 5th, it is recommended that the District hold to the August, 2020, policy change to safely allow for the increase in K-6 students, and to allow further analysis once those required routes are built this month. The Transportation Director's analysis is attached as Appendix D.

Cafeteria Operations

The District's Department of Nutrition Services is also finalizing plans to ensure as smooth of a transition as possible to this required change in learning model. Previously, the vast majority of meals were produced for grab-n-go distribution to remote learners. Aramark, the District's meal service provider, is finalizing plans for redesigning food service operations to produce and deliver hot meals to students within schools (see Appendix E).

To support this transition, all cafeteria staff, who had previously been laid off during times when certain kitchens were not in operation, have been recalled. Cooks hours have also been expanded to 40 hours per week. The District has also hired 24 cafeteria flex workers to assist with the delivery of meals to students in classrooms and recently expanded their work hours to 7.5 hours per day. These flex workers will focus on high-touch point cleaning when not utilized for the delivery of meals. Augmenting the cafeteria staff has been a necessity as the staff are producing meals for community distribution in addition to maintaining the school kitchen and producing meals for students within schools. Due to these challenges within the cafeterias, our Operations Department is focused on re-opening two kitchens per week over the next month.

Supporting student lunch schedules in schools will also require a new approach to space utilization to ensure 6-feet of distancing while masks are not worn. This may require small groups of students to go outside the classroom to eat in common spaces within the building, or as weather permits, outside of the building to eat in open-air, exterior spaces. Building principals are currently researching options to maximize the available staff and space at their schools for breakfast and lunch periods.

School-by-school differences are expected in how lunch occurs given the different setups of schools and classrooms.

Staffing Considerations

All staff will be expected to be in school buildings each day that students are in school buildings if they have any students on their class roster or caseload who are engaged in in-person learning.

However, the District will continue to maintain the medical exception process that has been in place for employees in the highest tier of risk under CDC guidelines which provides those employees with the accommodation of working from home for the duration of the academic year. Presently, there are approximately 80 employees total across position classifications who have qualified to participate in instruction remotely. LPS will also continue to offer employees who do not qualify for such a medical exception, but still have health and safety concerns, the opportunity to take an unpaid leave of absence and return at the start of the 2021-2022 school year.

To provide supervisory coverage for the classrooms of medically exempt teachers who will be working from home, HR is actively working to fill the supplemental staff positions that were approved by the School Committee on March 3rd. Among those positions are 50 paraprofessional positions which - in addition to supporting instruction where medically exempt teachers will be streaming their instruction into the classroom from home - will also assist with substitute teaching. Given the immense needs across the Commonwealth for certified staff, DESE has continued the authorization for individuals with college degrees to obtain emergency teaching licenses, and HR is currently recruiting recent college graduates to fill vacant positions in addition to the standard recruitment methods the District typically employs.

Potential Impact on Remote Learners

As LPS shifts to an expanded in-person learning environment, measures will continue to be taken to maintain the quality of the remote learning environment for students choosing to remain in remote learning through the end of the school year. However, the requirement of simultaneous/concurrent teaching will have an impact not only on students who are returning to in-person learning, but also those who remain at-home learning remotely as teachers and support staff adapt to this change. To minimize the impact on remote learners, class rosters will be kept as consistent as possible - although some changes may be required at certain schools - and all staff will have the opportunity to be trained on the concurrent/simultaneous instructional model. Teachers, who are shifting to a simultaneous/concurrent instructional model, will be encouraged and supported to continue to utilize materials from the remote instructional model and embed those materials into the in-person classroom experience. The District has invested in resources to support the remote learning environment, which are aligned to MA state standards and connected to the District's learning materials. The District has also committed to daily school schedules in the remote environment that mirror and transfer to in-person classroom schedules, which should further minimize the disruption to both remote and in-person learners.

Communication with Families

To support parents and guardians through this transition, the District has prioritized frequent communication with families as part of the planning process for expanding in-person learning, utilizing multiple forms of communication and providing all information in multiple languages.

In February, to assess our families' desire to return to in-person schooling in April, a *Return to School* survey - translated into seven different languages - was distributed to parents and guardians

of LPS students who have been participating in remote learning since the beginning of the school year (i.e. students who are not part of the District's 25% in-person model). The survey window was opened from February 3rd to February 23rd and was disseminated by each school. Each school utilized communications methods such as email, phone calls, and ClassDojo - a school-based communication tool - to reach as many families as possible.

Based on preliminary feedback from our families since the new DESE regulations were released on March 9th and experiences shared by other districts in MA, **we anticipate increased demand for in-person learning compared to the data that was gathered through the February survey now that full-time, in-person learning has been mandated across the Commonwealth.** Thus, school leaders have been subsequently following up with families to share the revised details of reopening based on DESE's regulatory changes. Schools are moving rapidly through the process of confirming the choice of in-person or remote learning for each student prior to finalizing their school-based plans for reopening.

In the immediate days ahead, the District will be following a similar approach to communication that was utilized at the prior transition periods between in-person and remote learning. Three family information sessions are scheduled for the week of March 15th to further engage, inform and support families through this process. Two sessions will be held in English with language interpretation services available, and one session will be held in Spanish. The district's bilingual family liaisons will subsequently hold small-group follow up sessions in Khmer, Portuguese, Spanish and Swahili. In addition, each school will host school-based orientations and family outreach sessions from March 17-26, leading up to the expansion of in-person learning for grades K to 5 on April 5th.

Next Steps

The following key dates and deliverables in March will be important for the School Committee to keep in mind as we continue to support the readiness of families, staff and school buildings for the transition to expanded in-person learning in April:

- March 15th and 16th: Districtwide virtual community forums
- March 17th to 26th: School-based virtual information and orientation sessions for families
- March 20th to 25th: Professional development for teachers and instructional support staff
- March 10th to 29th: Schools finalize school-based reopening plans; confirming student return, adjusting/fine-tuning master schedules, and reviewing and adjusting class rosters as needed
- *April 5th: First day of expanded in-person learning for grades K to 5*

Appendix

A. DESE Regulations and Guidance
B. Professional Development Schedule
C. Social Distancing Research
D. Transportation Director Memo
E. Aramark Plan

Cc: LPS Executive Cabinet

Appendix A

Guidance on In-Person Learning and Student Learning Time Requirements

March 9, 2021

Summary of Regulatory Change and New Requirements

At the meeting of the Board of Elementary and Secondary Education (Board) on March 5, 2021, the Board adopted additional amendments to the Student Learning Time (SLT) regulations, 603 CMR 27.00, on an emergency basis. The amendments establish the Commissioner's authority to determine when district-wide hybrid and remote learning models no longer count for structured learning time. Consistent with the regulations, the amendments prioritize in-person instruction and will result in more students returning to full-time, in-person learning with appropriate school-based mitigation measures in place.

The Department of Elementary and Secondary Education (Department or DESE) welcomes public comment on the emergency regulations. The Board will vote on the final adoption of the amendments, with any changes resulting from the public comments, at the Board meeting in May 2021.

In consultation with public health officials and medical experts, the Commissioner has elected to use this authority to expand full-time, in-person learning through a graduated approach this spring. **The plan will begin with a return to in-person school for elementary schools grades K-5. As of April 5, 2021, the Department will require elementary schools to use a full-time, in-person learning model for instructional hours to count towards structured learning time**. With recent significant improvements in COVID-19 health metrics, rigorous implementation of key mitigation strategies, and weekly pooled testing up and running for students and school staff across the Commonwealth, more districts and schools have already started to bring more students back, especially at the elementary level. **The plan will proceed with other grade levels at the Commissioner's discretion and in consultation with medical experts and state health officials.**

Importantly, families will retain the choice as to whether to send their children to school in-person or have them learn remotely through the end of the school year. Districts[1] may also apply for a waiver from DESE. Waivers will be considered in a limited set of circumstances described later in this document.

These regulations are legally binding. Any district that does not comply with the regulatory requirements or receive a waiver by April 5, 2021 (for the elementary school phase of the plan) will be required to make up any missed structured learning time. This time could be made up during this school year, over the summer, or into next school year if necessary. In addition, G.L. c. 71, § 4A links Chapter 70 funds to structured learning time.

Overview of this Document

This document provides further information to districts about the new requirements and guidance for effective implementation, and is organized into the following sections:

- Background and rationale
- Supports and resources for schools and districts
- Timeline for phased implementation
- Detailed requirements
- Implementation planning

- Waiver process
- Looking ahead

Background and Rationale

In preparation for reopening schools in the fall of 2020, DESE released its initial fall guidance[2] in June. Our initial guidance established a layered set of mitigation strategies to protect against COVID-19 transmission in schools, including masks, hand hygiene, physical distancing, cleaning and disinfecting, symptom screening, and contact tracing. We indicated that it was not one factor, but a combination of strategies that would keep our students and staff safe.

As part of this guidance, DESE required districts to prepare plans for three learning models heading into the 2020-21 school year – in-person, hybrid, and remote – while prioritizing in-person models whenever possible. Our expectation was that based on the evolving science and depending on the trajectory of the virus, schools would likely need to pivot among the models. We also modified the required number of school days to provide extra time at the start of the year for school staff to train on reopening models and the key mitigation strategies.[3]

Importantly, 72% of districts in Massachusetts took advantage of the fall months to return to school fully in-person or in a hybrid model. And based on recent SLT survey data, nearly 80% of districts are currently in-person or in a hybrid model as of mid-February 2021.

Schools and districts have rigorously adopted the health and safety strategies outlined in DESE's guidance and we have seen very few incidences of transmission in schools. In fact, we have an ever-growing body of evidence locally, nationally, and from across the globe that in-person school is safe when proper health and safety protocols are followed.[4,5,6,7,8,9]

Since June 2020, DESE guidance has consistently noted that three feet in classrooms is a safe standard for physical distancing when masks are worn and other mitigation strategies are in place, based on guidelines from the World Health Organization[10] and the American Academy of Pediatrics.[11] Our guidance balanced the urgent need to bring students in the Commonwealth back to in-person learning while minimizing the risk to students, staff, and their families. While districts should space students further than three feet when feasible, evidence demonstrates that the additional risk reduction associated with six feet as opposed to three feet is low – when masks are worn and other mitigation strategies are in place.[12,13,14,15,16,17,18,19]

DESE's approach to physical distancing was endorsed last summer by the Governor's COVID Command Medical Advisory board, the Massachusetts Chapter of the American Academy of Pediatrics, and medical experts from Mass General Brigham.

Since then, DESE's approach has been further endorsed and validated, with numerous groups noting the safety of a three-foot distancing in classrooms standard and supporting the return of students to full-time in-person school at three feet of distance:

- Additional organizations have noted the safety of a three-foot distancing standard between students in classrooms when part of a holistic mitigation approach in school.[20]
- Individual school districts have formed their own medical advisory boards and conducted their own due diligence, reaching with similar conclusions about the safety of reduced physical distancing.[21]

- Recently, hundreds of Massachusetts infectious diseases physicians, pediatricians, and public health experts, endorsed DESE's guidance on three feet of physical distancing in classrooms, noting that the risks to students of not being in school are dramatic.[22]
- In March 2021, a peer-reviewed study provisionally accepted to *Clinical Infectious Diseases* demonstrated that districts in Massachusetts using a physical distancing standard of three feet in classrooms did not see an increased number of COVID-19 positive cases, as compared to districts that maintained a strict six feet of distance.[23]

In the fall, we began adding further layers to the school-based mitigation strategies through COVID-19 testing and reporting practices. We implemented mobile rapid response testing and BinaxNOW rapid antigen testing for symptomatic individuals in schools. We also began publicly reporting the case rates in K-12 settings.[24]

In January 2021, we announced that pooled testing would be universally available across the Commonwealth for all students and staff, starting with a state-funded initial phase that began in February. Approximately 50% of schools across the Commonwealth have signed up to administer pooled testing on a weekly basis to proactively screen large numbers of students and staff for COVID-19. Participating schools can now quickly locate and isolate any individuals that test positive.

Starting March 11, 2021 all educators and school staff will be eligible to schedule appointments to receive the COVID-19 vaccine as part of Phase 2 of the state-wide vaccination rollout plan. Vaccinations for persons over 65 and those at risk of severe COVID-19 due to co-morbidities are already underway. Even with strong evidence that in-person school environments are safe with existing mitigation strategies,[25] and while vaccinations are not a prerequisite for returning to in-person instruction,[26] vaccination for educators and their vulnerable family members will provide additional confidence in returning to the classroom.

In recent months, we have also focused on the student learning experience in remote and hybrid settings. In December, to address increasing reports of troubling student mental health trends, the Board voted to amend the SLT regulations to require districts to further prioritize "live instruction," whether through in-person or synchronous remote learning. These emergency regulations went into effect for schools and districts on January 19, 2021 and were permanently adopted at the Board's February meeting. These requirements for live and synchronous instruction will support student engagement and mental health until students return to the classroom full-time.

As we have stated repeatedly throughout this pandemic, there is no substitute for in-person learning, especially for younger students, students with disabilities, English learners, and other high needs populations. In addition to academic instruction and support, when students are in school, they have the opportunity to learn important social and emotional skills, and they have access to mental health and other support services, as well as healthy meals and opportunities for exercise.

With the extensive mitigation strategies in place in our schools, including further validation of our guidance on physical distancing, widely-available pooled testing, and as state health metrics continue to improve, the time is now to begin shifting away from remote and hybrid learning models and return to the in-person instructional format.

In addition, a return to in-person school this spring will lay the groundwork for a full-time, in-person return for all grade levels in fall 2021, likely with some continued mitigation measures. In the fall, DESE will no longer require districts and schools to provide a district-wide remote learning option. Districts

should work individually with parents/guardians of students who cannot school in person in the fall due to a medical condition.

Supports and Resources for Schools and Districts

At the start of the pandemic, we recognized that planning, preparation, and implementation would come at a significant cost and advocated early for much-needed additional funding for schools. Beginning in summer 2020, hundreds of millions of federal and state dollars were made available to districts.

Specifically, DESE distributed $194.4 million through the Elementary and Secondary School Emergency Relief (ESSER I) Fund and $182 million in School Reopening grants were issued last summer. DESE also provided nearly $33 million to address remote learning technology needs and to provide students with adequate access to technology, including devices (e.g., Chromebooks), internet connectivity (e.g., wi-fi hotspots), and assistive technology, for use in remote learning environments during the 2020-21 school year. DESE has also provided districts and schools with additional supplies, including personal protective equipment, masks, and air purifiers. To date, DESE has distributed over 12,000 air purifiers and 1.5 million masks.

The additional $740 million federal stimulus funds (ESSER II) announced in December 2020, and the Governor's proposed budget which fully funds the Student Opportunity Act, will enable districts to plan not just for immediate needs but also for long-term recovery and student acceleration. As part of the ESSER II package, DESE has committed additional resources to ensure that each district will receive a minimum of $75,000 in ESSER II funds. DESE has also distributed $4 million in supplemental funding to assist with the social and emotional needs of students. An even larger distribution of federal funds is expected as part of the pending American Rescue Plan.

Additionally, DESE continues to provide resources for districts and schools to hire additional staff to support an in-person return including: emergency license opportunities,[27] MassHire Department of Career Services (MDCS) database partnership for substitute teachers,[28] and the high school internship program.[29]

Finally, DESE's COVID-19 rapid response help center has been in place since the fall to support districts and schools with reopening questions, provide guidance on managing positive COVID-19 cases in schools through DESE's protocols, and providing operational guidance and support. The help center will continue to be available, including onsite, to support districts and schools in expanding the number of students engaged in full-time, in-person learning this spring. For schools and districts seeking additional support, contact SLTsupport@mass.gov.

Timeline for Phased Implementation

With the authority to determine when remote and hybrid learning models no longer count towards structured learning time hours, the Commissioner has laid out a graduated strategy for providing all students with the opportunity to return to full-time, in-person learning this spring, beginning with elementary students.

We encourage schools and districts to bring back students at each grade level as quickly as possible. With pooled testing in place and improvement in COVID-19 heath metrics across the state, many districts and schools are already moving to bring back all students K-12 for full-time, in-person learning in the coming weeks. However, the timeline below represents the requirement for full-

time return for districts who would not otherwise have students back by the dates below at each grade level.

With this timeline, DESE aims to steadily increase the number of students learning in-person for the remainder of the school year. The plan unfolds in phases, allowing us to assess implementation and health indicators before moving to the next phase. During these phases, we will work in close collaboration with state health officials and medical experts to monitor case counts in schools, assess public health metrics, and monitor for potential impacts of the COVID-19 variants. In addition, we will seek feedback from district and school leaders on implementation. Ultimately, the Commissioner will confirm the timeline for proceeding to subsequent phases based on the review of these data points and other relevant findings from implementation, and following written notice to the Board.

We know COVID-19 positive individuals will be identified in schools, as has been the case throughout the school year. However, districts and schools are well-equipped with the necessary protocols to effectively manage these cases and prevent in-school transmission, including the testing, contact tracing, and quarantine procedures found in DESE guidance.

While the timeline below is subject to change, the following dates provide a roadmap for local planning this spring. In reviewing the timeline below, please note that districts and schools may apply for a waiver from DESE, and parents/guardians who wish for their children to learn remotely will still have that option. Schools and districts must have robust and reliable ways to communicate with all families, students, teachers, and staff to send and receive key messages related to the timelines below. To the greatest extent possible, districts and schools should give families, remote enrichment learning programs, and the broader community at least a two-week notice of planned changes to their school schedules.

- **Elementary school phase (grades K-5):** Districts and schools are required to shift their learning model for elementary school grade levels to full-time, in-person instruction five days per week effective **Monday, April 5, 2021.**

- **Middle school phase (grades 6-8):** Districts and schools will be required to shift their learning model for middle school grade levels to full-time, in-person instruction five days per week, effective **Wednesday, April 28, 2021.** Districts may choose to ask students who have traveled to a state on the restricted list to learn remotely for the week of April 26, 2021 (the week after April vacation).

- **High school phase (grades 9-12): We will announce the details and timing of the high school phase of the plan in April.** Districts will be provided with at least two weeks advance notice of the specific date requirement for high school students but should start making such plans now.

The Commissioner may delay or accelerate the timeline for subsequent phases of the plan in consultation with medical experts and state health officials.

Detailed Requirements

Below are key requirements and other information necessary for implementation.

Survey families to determine their choice between full in-person and remote learning. As the new requirements take effect for each phase (elementary, middle, and high school), parent/guardians have the option to choose full in-person or remote learning for their students. These options apply whether the students are currently in remote learning, hybrid, or in-person learning. **The family surveys should be conducted as soon as possible for all students K-12**, and districts should make every effort to reach all families.

For many districts, this will be a substantial programming shift mid-school year. Families should expect that districts may need to make challenging tradeoffs to accommodate the full in-person instructional mode. For instance, if students are currently learning in a hybrid model, the shift to more in-person days may require changes in classroom learning spaces and, in some cases, teacher-student assignments. If students are currently in a remote model or choose to learn remotely when these new requirements go into effect, the remote learning option may look different than the model offered prior to the implementation of these new requirements.

After families make a choice between full in-person and remote, a parent or guardian who subsequently wishes to have their student switch from a remote to in-person model, should be aware that the school or district may require a reasonable transition period. Consistent with DESE's Remote Learning Guidance,[30] we recommend that this transition period be ideally no more than four to six weeks.

We encourage districts to use a "livestreaming" or simultaneous instructional model for remote students. In this model, students learning at home participate in largely the same classroom activities as students who are learning in-person. This will continue to allow students to access remote learning if they need to quarantine this spring due to a COVID-19 related issue.

Applicable elementary grades. The requirement for full-time, in-person learning for elementary schools applies to all grades K-5 within a district or school. However, if districts or schools have one or more school building configurations of K-4, they may request a waiver from DESE to delay the implementation of full-time, in-person learning for grade 5 until the middle school implementation timeline begins.

Districts that have school building configurations of grades K-6, K-7, or K-8 may similarly opt to accelerate their implementation of full-time, in-person instruction in grades 6, 7, and 8, or they may choose to begin with K-5 and keep upper grades learning in hybrid or remote models.

Pre-kindergarten grades are not required to meet these new standards, though districts are encouraged to plan for a return to in-person learning for pre-kindergarten as soon as possible.

Definition of full-time in-person learning. The requirement for "full-time" in-person learning means that **all structured learning time hours[31] (on average 5 hours per day of structured learning time at the elementary level and 5.5 hours per day at the secondary level) are required to be delivered in-person, five days per week**. This will generally mean that students are attending a full school day equivalent to the length of their school day pre-pandemic. Any deviation from offering full-time, in-person instruction five days a week to all students requires a waiver.

Students can still learn remotely and have their hours count towards SLT in two "exception cases." First, as noted above, parents/guardians may choose to have their students learn remotely through the end of this school year, and the learning hours for these students will continue to count towards structured learning time. Second, following DESE COVID-19 health protocols,[32] individual students may need to isolate or quarantine and therefore learn remotely if they are symptomatic, diagnosed with COVID-19, or are a close contact of someone who tests positive. In these cases, where the district is following the DESE

COVID-19 health protocols and students are learning remotely due to a COVID-19-related issue, learning hours will also continue to count towards structured learning time.

As noted in DESE's Updated Guidance on Interpreting DPH COVID-19 Health Metrics issued in November,[33] schools should remain open at all levels of community prevalence and districts and schools should follow DESE's COVID-19 protocols in effectively managing any COVID-19 cases in schools. There are processes already in place to effectively manage any COVID-19 cases in schools, including contact tracing to isolate any positive individuals and their close contacts and working with the local board of health to determine if it is likely that there is transmission happening in school. Districts and schools must continue to consult with DESE's COVID-19 rapid response help center and the local board of health prior to shutting down a school or district due to suspected in-school transmission.

School committee vote. Because the regulations have the force of law, once the Commissioner makes the determination that hybrid and remote learning will no longer count towards structured learning time, a school committee vote on which learning model to adopt is not necessary because full-time, in-person learning will be the default required model. Remote learning should be provided only if parents/guardians opt out of in-person learning for the remainder of this school year and for students who must remain home due to a COVID-19 related issue. If a district intends to submit a waiver request, DESE encourages the district to hold a school committee vote on the content of the waiver, but this is a local decision. Given the need for rapid implementation, superintendents may submit a waiver request to DESE without having first secured a school committee vote.

Coordination with remote learning enrichment centers and other community providers currently supporting remote learning. Districts and schools should coordinate closely with remote learning enrichment centers and community-based programs that have been providing student support services during the regular school day. Districts should endeavor to notify all such providers at least two weeks prior to the implementation of any planned changes to the school schedule, to ensure parents continue to have access to the wrap-around care they need to return to work.

Districts and schools should work with community-based providers to plan for effective transitions to enable the continuity of services for children whose parents opt to keep them in a remote learning environment through the remainder of the school year. Districts and schools are encouraged continue to build partnerships with community providers to enable sufficient access to critical wrap-around services, complement and strengthen expanded summer learning opportunities, and maintain capacity for on-going early education and out-of-school-time needs for families across the district. Districts may also seek feedback from these programs, with parental consent, on student needs and developmental challenges.

Implementation Planning[34]

Student Supports

When these new requirements go into effect in early April, some schools and districts will be returning students to in-person learning for the first time this school year. In such instances, students and families may require additional supports to successfully make this transition, particularly for students with disabilities, students who experience anxiety and mental health issues, and other vulnerable populations. DESE recommends that schools and districts take additional steps to prepare such students and families so they can take full advantage of the opportunities for learning and socialization that in-person instruction will create, including:

- **Family engagement is a critical component of school reopening**. It is essential to reach out to parents/guardians and promote ongoing engagement in a manner that works for the family. DESE strongly recommends that schools and districts continue to cultivate excellent two-way communication with families. All written and oral communication must be provided in the primary language of the home and in language that is understandable to the general public.
- **Parental input is always valuable but is particularly critical during this time when parents/guardians may have unique insight into their child's remote learning experience**. Input from parents/guardians on their child's primary areas of need, including their child's engagement, attention, behavior, progress, skills, home experiences, and other observations about their emotional and social well-being, are critical to determining how to meet students' needs.
- **Schools and districts should partner with parents/guardians to support a smooth transition to re-opening of school,** with physical distancing and other health and safety protocols as well as new schedules. It is particularly important that educators work closely with parents/guardians of students who experience difficulty with changes in routine (for example, students with autism or students who experience anxiety). Schools and districts should consider strategies such as creating individualized social stories[35], recording tours of new buildings or programs, conducting virtual tours, holding a "meet and greet" for teachers with their students, or providing opportunities for students to ride new bus routes and visit new school buildings in person before the resumption of in-person learning.
- **Schools and districts should continue to create safe and supportive learning environments that encourage positive behavior**. Schools should proactively implement direct instruction and additional supports for school- and class-wide routines, social skills instruction, and other preventive measures. Schools and districts should utilize disciplinary action as a last resort for students exhibiting behavioral challenges.
- **Additional de-escalation training and/or training on trauma-sensitive practices for all staff including school resource officers may be needed** to support the transition back to full-time in-person learning modified for health and safety needs, and the potential of increased behavioral concerns.
- **IEP teams must ensure that a free appropriate public education is provided to all students with disabilities**. Whether the primary instructional delivery is in-person learning or remote learning, students with disabilities must receive all services in accordance with their IEP.

Facilities and Operations

As noted, DESE's initial fall reopening guidance[36] explicitly endorsed a full return to classrooms following health and safety protocols, including three feet of distance between students in classrooms when masks are worn and other mitigation strategies are in place. **We encourage districts to revisit this guidance as they plan for a full-time return this spring. DESE's facilities and operations guidance[37] will also serve as a helpful resource for building configuration and space planning work.**

As a reminder, we recently issued **updated transportation guidance[38] that significantly expanded bus capacity.**

In addition, **we are updating our face mask guidance to require masks at all grade levels, unless students receive a medical or behavioral exemption.[39]** Previously, masks were strongly encouraged in grades 1 and below, but not required. **This requirement is effective immediately and other DESE guidance documents will be revised accordingly in the coming days.**

We recognize that, at this point, the critical constraint most districts are facing in bringing more students back for in-person instruction is physical distancing. Below are some important points to keep in mind regarding physical distancing and space configuration. In consultation with state health officials and medical experts, DESE will provide periodic updates to these guidelines.

In general, districts and schools should review a wide range of options for serving all students full-time, in-person with physical distancing constraints:

- Classroom capacity should be assessed first, followed by other spaces in the school that could be repurposed at different times of the day, including the cafeteria, gym, art and music rooms, and other spaces. Classroom configurations including layout and furniture may need to be altered to accommodate all students.
- Some teachers, including specialist teachers, may be able to utilize carts and deliver lessons in students' homerooms, thereby freeing up additional classroom space and allowing students to remain in cohorts. In some cases, shifts in teacher assignments may also be required.
- Use of outdoor spaces at the school should be maximized, including putting up tents so these spaces can be used in rainy weather.
- If indoor and outdoor spaces at the school-level are insufficient, districts should look at other spaces not otherwise used by students within the district, if available, and then consider spaces within the broader community. For instance, individual grade levels within a school could be moved to local community spaces, including non-profits, businesses, or other spaces, to expand the physical footprint of classroom space.

Classroom set-up and required physical distancing:

- **As a reminder, our guidance is to set up classrooms with desks at least three feet apart, with students facing the same direction**. The three feet distance is measured "seat edge to seat edge" front to back and side to side.
    - Having students face the same direction should be the default desk set-up in the classroom.
    - However, for short periods of time (e.g. 15-20 minutes several times per day), students may face each other for a "turn and talk" or other group activity. During these short periods, students should refrain from singing or engaging in activities that involve increased respiration. Appropriate mask use should be verified before these short periods.

- **Please see DESE's facilities and operations guidance[40] for further suggestions on classroom set-up and maximizing space for students.**

- **In elementary schools, if the typical classroom configuration is tables with students facing one another**, consider the following strategies to fit students at three feet apart in classrooms:
    - Replace tables with individual desks, if feasible.
    - Reduce the number of students at each table and relocate additional students to another area of the classroom, if feasible. For example, for tables that typically seat four students, one pair of students sits together at the table in the morning and then shifts to the rug for the afternoon, while another pair of students starts on the rug and shifts to the table in the afternoon.
    - Have all students at the table face in one direction, at least three feet apart, with the students facing away from the table using clipboards or lap desks. Again, the pair using clipboards or lap desks could switch with the other pair at the table halfway through the day.

Meal set-up and required physical distancing:

- **During meals, and any other time students and adults are not wearing masks, districts and schools must plan for a strict six feet of physical distance between individuals.**

- **Consider the following strategies to increase physical space for meals:**
  - Add additional meal periods to reduce the number of students in the cafeteria during each session. (This may include shortening lunch periods.)
  - Have students eat meals in the classroom. (If classroom space is set up with three feet of distance between seats, have the other half of the class eat in another area.)
  - Alternate students between recess and lunch to reduce classroom or cafeteria capacity during meals (e.g., half the students eat lunch while the other half attend recess).
  - Repurpose other space as meal areas including gyms, art rooms, or music rooms (depending on the scheduling of specials, this may require teachers to utilize carts for part of the day).
  - Set up eating areas outside, including in tents. This could expand cafeteria capacity or could provide an alternative space for students eating meals in classrooms (e.g., half the students stay in their classroom; the other half eat in the tents).
  - Replace café tables with desks in the cafeteria to increase capacity at six feet of distancing.

- **Consider the following strategies for increasing staffing to cover meal periods:**
  - To provide sufficient staff to monitor students during meals, repurpose paraprofessionals, other support staff, school administrators, or hire lunch monitors (bus company monitors or crossing guards may be available, high school student interns, parent volunteers, etc.).
  - To have teachers supervise meals in classroom, schedule teachers' duty-free lunch at the end of the day and allow for a 30-minute early release.

- **Please see DESE's facilities and operations guidance[41] for further suggestions on lunchroom set-up. DESE will continue to collaborate with school and district leaders to collect and share effective strategies for lunchroom set-up.**

Physical distancing at other times of the day:

- **At all other times (passing time, transitions, etc.), students should maintain physical distance from one another as feasible, and follow the guidelines below.** More information can be found in DESE's facilities and operations guidance:[42]
  - Ensure that students keep their masks on properly.
  - Ensure that students do not congregate in the hallways or other spaces. During transition periods, we encourage all teachers and staff to monitor students (e.g., from doorways) to keep students moving.
  - Schools should continue to stagger transitions as feasible and students should not use lockers (or locker use should be staggered) to prevent congregation.
  - Schools should continue not to host visitors to the extent possible.
  - Use signage and other markers to remind students and staff to follow proper health and safety protocols, to indicate direction of travel and to encourage physical distancing.
  - To account for increased volume of students during passing time, schools may consider increasing installations of hand sanitizer, while ensuring hand sanitizer use is appropriately monitored with younger students.

- Allow students to use the bathroom during class time to reduce bathroom use during transition times, and otherwise using a bathroom sign-out system to reduce the number of students in the bathroom at one time.

Teacher and staff spaces and protocols:

- **In many studies, adult-to-adult transmission has been more common than transmission between adults and students in schools.[43,44,45,46] While teachers and other adults should always remain vigilant implementing the health and safety mitigation strategies, they should be especially careful not to relax their mitigation measures during duty-free periods or other times students may not be present (e.g., preparation periods, common planning time, professional development, etc.).** Consider the following strategies for these circumstances:
  - Ensure strict use of masks when adults are present together.
  - Reconfigure staff furniture to support physical distancing.
  - Consider adjusting staff schedules or creating adult occupancy thresholds to limit the number of adults in a room at one time.
  - Encourage the use of virtual staff meetings where feasible, as opposed to gathering in-person. For in-person staff meetings or gatherings, do not provide food which can lead to the removal of masks.
  - During duty-free lunch periods, encourage staff to eat outside or individually in their classrooms.

- **Teachers and staff should maintain six feet of distance from students and other staff when feasible. For short periods of time (e.g., helping a student individually, walking between desks, etc.), teachers and other staff may be less than six feet away from others.**

We recognize that planning for these configurations and protocols is not simple and that building configuration vary. At the same time, many communities have already returned to full-time in-person learning at the elementary level, demonstrating that it is possible.

DESE's COVID-19 help center is available to serve as a thought partner to any district or school that is challenged by space constraints. Contact SLTsupport@mass.gov to request this support.

Waiver Process

The recent student learning time amendments include that upon the written request of a school or district leader, the **Commissioner may, in his discretion, grant a waiver for a limited set of circumstances in which districts make a compelling case that they must take an incremental approach to implementation of these requirements**. Any deviation from offering full-time, in-person instruction five days a week to all students requires a waiver request.

Examples of possible waiver requests (where districts and schools must make a compelling case that they must take an incremental approach to implementation):

1. Schools and districts that have been primarily in a fully remote model all year can submit a waiver if they need additional time to return all students to full-time, in-person instruction (for instance seeking first to return in a hybrid model, before proceeding to full in-person instruction later in this school year). **Districts must include a timeline and date in which all students within a phase would have access to full-time, in-person instruction this school year.**

2. Schools that operate with a grades K-4 configuration, with grade 5 in another school building, can submit a waiver to delay implementation of full-time, in-person learning for grade 5 at those buildings until the middle school phase begins.

3. In very limited circumstances, waivers may be considered for operational constraints and feasibility issues, on a temporary basis. Schools and districts considering submitting a waiver for issues related to facilities and space constraints should review the "Implementation Planning" section of this document as well as DESE's facilities and operations guidance. If districts and schools are still in need of support, please email SLTsupport@mass.gov. We will set up consultations, including onsite, with districts to assess how they can implement these requirements. **These consultations with DESE will be required before the Commissioner will approve any waivers in this area.**

   Waivers will not be granted for districts that indicate they cannot return to in-person learning due to space constraints or feasibility issues but are maintaining a physical distancing standard in classrooms of greater than three feet. Districts must also have completed an **updated survey of families** with the information about those students have elected to return to in-person instruction and those who have elected to learn remotely.

   In addition, in those limited circumstances where a is granted a waiver, the **waiver will be time limited. All districts and school should expect that they will need to change their models to move closer to full-time, in-person learning five days per week.**

   Finally, if districts can bring some – but not all – of their schools back to full in-person learning within a given phase (e.g. four out of six elementary schools), they should proceed with a full return for those schools and submit a waiver to continue working on plans for the others.

4. Other requests will be considered on a case-by-case basis.

As noted in earlier sections of this document, schools have been open for in-person learning safely, even in communities with high prevalence, with adherence to required COVID-19 mitigation strategies. In addition, COVID-19 case rates across the Commonwealth have decreased significantly since January 2021, with the vast majority of communities now in yellow, green, or gray. **As such, for the elementary phase of this plan, we do not anticipate granting waivers for reasons of high community prevalence of COVID-19.** We will work closely with health officials and local communities to monitor the case rates in schools following the implementation of the elementary school phase as we plan for subsequent phases.

Waiver duration: Waivers will be approved for a limited time only. All requests for waivers must include a timeline in which all students within a phase would have access to full-time, in-person instruction this school year (i.e., identify the week full-time, in-person instruction would begin).

Any request for a waiver should be addressed from the district or school leader (e.g., superintendent or executive director) to the Commissioner and submitted by email to SLTsupport@mass.gov.

In order for districts and schools to receive a timely response prior to the respective elementary and middle school implementation dates:

- Elementary school waiver requests must be submitted to DESE by Monday, March 22, 2021 at 5pm, and
- Middle school waiver requests must be submitted to DESE by Monday, April 12, 2021 at 5pm.

Districts may also submit waivers for the elementary and middle school phases together, by the elementary school deadline. The Department will respond to waiver requests on a rolling basis, and we encourage districts to submit as soon as possible. **Districts and schools will receive a response within five business days of submitting a waiver request.**

The request must include the following information:

- Identification of the district or school(s) requesting the waiver;
- Description of the specific requested waiver, including the physical distancing standard used in the district, the results of the family survey regarding the number of students who would be returning in-person vs. learning remotely, and the timeline in which all students within a phase would have access to in-person, full-time instruction this school year;
- Rationale for the request, including a full description of the circumstances justifying the request;
- Point of contact and phone number.

Looking Ahead

Returning all students to the classroom full-time this school year is a crucial step to stem student learning loss. At the same time, we must also focus on recovery and acceleration, especially for students most in need of intensive support. Plans for recovery and acceleration must initially focus on near-term efforts in 2021, including enhanced student supports this spring, opportunities for summer learning, and planning for a strong start to the fall. However, given pervasive student needs and the availability of significant financial resources across several fiscal years, we must ultimately craft a plan for multi-year recovery efforts.

Later this spring, we will release further information related to summer recovery and acceleration and fall planning. DESE intends to provide the following resources and supports, among others:

- **Spring**: DESE will provide student supports this spring in key areas, including increased mental health supports, FAFSA completion, and support for seniors who did not meet the Competency Determination.

- **Summer:** DESE will stand up robust summer school programming and academic interventions, which will include a state-wide acceleration academy program with a focus on "gateway grades." DESE will select key grades and focus areas (e.g. early literacy, middle grades math), and work with districts to provide a multi-year opportunity for students to attend an academy program this summer. In addition, DESE will support districts in identifying high-quality programs to serve students in other grades. For planning purposes, DESE recommends that summer programs, including extended school year programs, be provided in-person for all student groups.

- **Fall:** DESE anticipates a full in-person return across all grade levels. We will work with districts and schools to ensure a focus on teaching grade level content, with appropriate scaffolds for all learners. We will also support districts in meeting the needs of the whole child, including mental and physical health, in addition to accelerated instruction and extra help in core academic subjects. More guidance on fall planning will be forthcoming.
    - As we stated last spring heading into the 2020-21 school year, DESE discourages retaining students at the prior grade level. This includes students of first grade age whose parents/guardians may have kept them home from kindergarten this year; these students

should be placed in the first grade in the fall, even if they chose to remain unenrolled for kindergarten.

In addition, we remain committed to the Commissioner's *Our Way Forward* plan, which will support our post-COVID-19 instructional focus and strengthen teaching and learning statewide. This includes promoting deeper learning through engaging and relevant performance tasks and revamping student assessment through our innovative science assessment pilot program.

We have much work ahead to support the return to full-time, in-person school for all students and begin the process of recovery and acceleration. We commend your efforts and look forward to partnering with district and school leaders, school committees, educators and school staff, families, and other stakeholders on behalf of students.

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[1] "District" shall mean a municipal school department or regional school district, acting through its school committee or superintendent of schools, a county agricultural school, acting through its board of trustees or superintendent/director, any other public school established by statute or charter, acting through its governing board or director. 603 CMR 27.02.

[2] DESE's Fall Reopening Guidance is available at: https://www.doe.mass.edu/covid19/on-desktop/2020-0625fall-reopening.docx *(download)*

[3] The Memorandum of Understanding between DESE, MTA, AFT-MA, and BTU is available at https://www.doe.mass.edu/covid19/on-desktop/2020-0727mou.docx *(download)*

[4] Zimmerman KO, Akinboyo IC, Brookhart A, et al. (2021). Incidence and secondary transmission of SARS-CoV-2 infections in schools. Pediatrics. Available at https://pediatrics.aappublications.org/content/pediatrics/early/2021/01/06/peds.2020-048090.full.pdf

[5] Fricchione, M. J., Seo, J. Y., Arwady, M. A. (2020). Data-Driven Reopening of Urban Public Education Through Chicago's Tracking COVID-19 School Transmission. Available at https://journals.lww.com/jphmp/Abstract/9000/Data_Driven_Reopening_of_Urban_Public_Education.99206.aspx

[6] Falk, A., Benda, A., Falk, P., Steffen, S., Wallace, Z., Hoeg, TB. (2020). COVID-19 Cases and Transmission in 17 K-12 Schools. Available at http://dx.doi.org/10.15585/mmwr.mm7004e3

[7] Gillespie, D., Meyers, L., Lachmann, M., Redd, S., Zenilman, J. (2021). The Experience of Two Independent Schools with In-Person Learning During the COVID-19 Pandemic. [Preprint]. Available at https://www.medrxiv.org/content/10.1101/2021.01.26.21250065v1.full.pdf

[8] Schoeps, A., Hoffmann, A., Tamm, C., Vollmer, B., Haag, S., Kaffenberger, T., Ferguson-Beiser, K., Kohlhase-Griebel, B., Basenach, S., Missal, A., Hofling, K., Michels, H., Schall, A., Kappes, H., Vogt, M., Jahn, K., Barnighausen, T., Zanger, P. (2021). COVID-19 Transmission in Educational Institutions August to December 2020, Rhineland-Palatinate, Germany: A Study of Index Cases and Close Contact Cohorts. [Preprint]. Available at https://www.medrxiv.org/content/10.1101/2021.02.04.21250670v1.article-info

[9] National Centre for Immunisation Research and Surveillance (NCIRS). (2020). COVID-19 in Schools and Early Childhood Education Care Services. Available at https://www.ncirs.org.au/sites/default/files/2020-10/COVID-19%20Transmission%20in%20educational%20settings%20in%20NSW%20Term%203%20report_0.pdf

[10] World Health Organization (WHO). (2020). Considerations for school-related public health measures in the context of COVID-19. Available at https://www.who.int/publications/i/item/considerations-for-school-related-public-health-measures-in-the-context-of-covid-19

[11] American Academy of Pediatrics. (2020). COVID-19 Planning Considerations: Guidance for School Re-entry. Available at https://services.aap.org/en/pages/2019-novel-coronavirus-covid-19-infections/clinical-guidance/covid-19-planning-considerations-return-to-in-person-education-in-schools

[12] Booth, W. (2020). Two Meters? One Meter Plus? Social Distancing Rules Prompt Fierce Debate in U.K. The Washington Post. Available at https://www.washingtonpost.com/world/europe/covid-social-distancing-one-meter-plus/2020/06/22/7614418a-afe0-11ea-98b5-279a6479a1e4_story.html

[13] Ismail, S., Saliba, V., Bernal, J. L., Ramsay, M., & Ladhani, S. (2020). SARS-CoV-2 infection and transmission in educational settings: cross-sectional analysis of clusters and outbreaks in England. Public Health England. The Lancet. Available at: https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30882-3/fulltext

[14] Link-Gelles, R., DellaGrotta, A., Molina, C., Clyne, A., & Brandy, U. (2020). Limited Secondary Transmission of SARS-CoV-2 in Child Care Programs – Rhode Island, June 1 – July 31, 2020. Morbidity and Mortality Weekly Report. Available at https://www.cdc.gov/mmwr/volumes/69/wr/mm6934e2.htm

[15] Brooks, J.T., Butler, J,C., (2021). Effectiveness of Mask Wearing to Control Community Spread of SARS-CoV-2. JAMA Insights. Available at https://jamanetwork.com/journals/jama/fullarticle/2776536

[16] Larosa, E., Djuric, O., Cassinardri, M., Cilloni, S., Bisaccia, E., Vincente, M., Venturelli, F., Giorgi P. R., Pezzotti, P., Bedeschi, E., the Reggio Emilia COVID-19 Working Group. (2020). Secondary Transmission of COVID-19 in Preschool and School Settings in Northern Italy After Their Reopening in September 2020. Available at https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.49.2001911

[17] Falk, A., Benda, A., Falk, P., Steffen, S., Wallace, Z., Hoeg, TB. (2020). COVID-19 Cases and Transmission in 17 K-12 Schools. Available at http://dx.doi.org/10.15585/mmwr.mm7004e3

[18] Schoeps, A., Hoffmann, A., Tamm, C., Vollmer, B., Haag, S., Kaffenberger, T., Ferguson-Beiser, K., Kohlhase-Griebel, B., Basenach, S., Missal, A., Hofling, K., Michels, H., Schall, A., Kappes, H., Vogt, M., Jahn, K., Barnighausen, T., Zanger, P. (2021). COVID-19 Transmission in Educational Institutions August to December 2020, Rhineland-Palatinate, Germany: A Study of Index Cases and Close Contact Cohorts. Available at https://www.medrxiv.org/content/10.1101/2021.02.04.21250670v1.article-info

[19] Chu, D.K., Akl, E.A., Duda S., Solo K., Yaacoub S., Schunemann H.J. et al. (2020) Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. The Lancet. Available at: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)31142-9/fulltext

[20] Brown School of Public Health, Edmond J. Safra Center for Ethics, & New America. (2020). Strategies for Pandemic Resilience in the Face of High Community Spread. Available at https://globalepidemics.org/2020/12/18/schools-and-the-path-to-zero-strategies-for-pandemic-resilience-in-the-face-of-high-community-spread/

[21] The Public Schools of Brookline. (2021). Evidence of Scientific Consensus In Support of Reduction of 6-Foot Distancing Parameters. Available at https://www.brookline.k12.ma.us/cms/lib/MA01907509/Centricity/Domain/25/Evidence%20of%20Scientific%20Consensus_Reduction%20of%20Distancing%20Parameters_2.18.21.pdf

[22] February 28, 2021 physician letter. Available at: https://www.doe.mass.edu/bese/docs/fy2021/2021-03/item1b.2-2021-0228physician-letter.pdf

[23] Study forthcoming. Polly van den Berg, MD; Elissa M. Schechter-Perkins, MD, MPH; Rebecca S. Jack, MPP; Isabella Epshtein, MPP; Richard Nelson, PhD; Emily Oster, PhD; Westyn Branch-Elliman, MD, MMSc., (2021). SARS-CoV-2 Cases in Students and Staff in Massachusetts with Variable Distancing Policies. Infection control plans for Commonwealth school districts with any in person learning were collected, with universal masking for students in grade 3 and higher and universal masking for staff mandatory. 243 districts were included, comprising 520,129 students and 6,227,765 student learning weeks, and 97,679 staff and 1,313,532 staff learning weeks. SARS-CoV-2 cases in students and staff in districts with in-person learning with different distancing policies were compared.

[24] COVID-19 Response Reporting is available at https://www.mass.gov/info-details/covid-19-response-reporting

[25] See footnotes 12-19.

[26] Centers for Disease Control. Operational Strategy for K-12 Schools through Phased Mitigation (2021). Available at https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/operation-strategy.html

[27] More information about the emergency license provision for educators is available at: https://www.doe.mass.edu/covid19/licensure/emergency-license-extended.html

[28] Commissioner's Weekly Update, February 22, 2021. Available at: https://mailchi.mp/doe.mass.edu/commissioners-weekly-update-2-22-21-board-to-meet-gsa-student-leadership-council-info-session-on-expanding-stem-ap-access?e=583fc2bc03

[29] More information about the high school internship program is available at: http://www.massconnecting.org/default.asp?entity_id=516

[30] The Remote Learning guidance is available at: https://www.doe.mass.edu/covid19/return-to-school/2020-0724remote-learning-guide.docx (*download*)

[31] At the meeting of the Board of Elementary and Secondary Education on June 30, 2020, the Board adopted amendments to the Student Learning Time regulations, 603 CMR 27.00, on an emergency basis. The Commissioner reduced the 180 day and student learning time requirements for the 2020-2021 school year to 170 days and 850 hours (for elementary schools) and 935 hours (for secondary schools). The summary of the amendments is available at: https://www.doe.mass.edu/bese/docs/fy2020/2020-06/item1b.docx *(download)*

[32] The DESE COVID-19 health protocols is available at: https://www.doe.mass.edu/covid19/on-desktop/protocols/.

[33] Updated Guidance on Interpreting DPH COVID-19 Health Metrics is available at: https://www.doe.mass.edu/covid19/on-desktop/interpreting-dph-metrics.html

[34] The documents referenced in this section specifically and throughout the document (e.g., fall reopening guidance, facilities and operations guidance, updated transportation guidance, etc.) can be found on the COVID-19/On the Desktop section of the DESE website: https://www.doe.mass.edu/covid19/on-desktop.html

[35] Information on social stories is available at: https://carolgraysocialstories.com/social-stories/what-is-it/

[36] DESE's Fall Reopening Guidance is available at: https://www.doe.mass.edu/covid19/on-desktop/2020-0625fall-reopening.docx *(download)*

[37] DESE's Facilities and Operations Guidance is available at: https://www.doe.mass.edu/covid19/on-desktop/2020-0722facilities-operations-guide.docx *(download)*

[38] DESE's updated Transportation Guidance is available at: https://www.doe.mass.edu/covid19/on-desktop/2020-0722transport-guide.docx *(download)*

[39] Additional information for school health offices is available at: https://www.mass.gov/doc/information-for-school-health-offices/download

[40] DESE's Facilities and Operations Guidance is available at: https://www.doe.mass.edu/covid19/on-desktop/2020-0722facilities-operations-guide.docx *(download)*

[41] DESE's Facilities and Operations Guidance is available at: https://www.doe.mass.edu/covid19/on-desktop/2020-0722facilities-operations-guide.docx *(download)*

[42] DESE's Facilities and Operations Guidance is available at: https://www.doe.mass.edu/covid19/on-desktop/2020-0722facilities-operations-guide.docx *(download)*

[43] Schoeps, A., Hoffmann, A., Tamm, C., Vollmer, B., Haag, S., Kaffenberger, T., Ferguson-Beiser, K., Kohlhase-Griebel, B., Basenach, S., Missal, A., Hofling, K., Michels, H., Schall, A., Kappes, H., Vogt, M., Jahn, K., Barnighausen, T., Zanger, P. (2021). COVID-19 Transmission in Educational Institutions August to December 2020, Rhineland-Palatinate, Germany: A Study of Index Cases and Close Contact Cohorts. Available at https://www.medrxiv.org/content/10.1101/2021.02.04.21250670v1.article-info

[44] Gillespie, D., Meyers, L., Lachmann, M., Redd, S., Zenilman, J. (2021). The Experience of Two Independent Schools with In-Person Learning During the COVID-19 Pandemic. Available at https://www.medrxiv.org/content/10.1101/2021.01.26.21250065v1.full.pdf

[45] Zimmerman KO, Akinboyo IC, Brookhart A, et al. (2021). Incidence and secondary transmission of SARS-CoV-2 infections in schools. Pediatrics. Available at https://pediatrics.aappublications.org/content/pediatrics/early/2021/01/06/peds.2020-048090.full.pdf

[46] Ismail, S., Saliba, V., Bernal, J. L., Ramsay, M., & Ladhani, S. (2020). SARS-CoV-2 infection and transmission in educational settings: cross-sectional analysis of clusters and outbreaks in England. Public Health England. The Lancet. Available at: https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30882-3/fulltext

Appendix B

Saturday 3/20				
9:00	9. Getting Started! Ideas for Teaching Special Education Students Concurrently (beginner level) w/ Gray Consulting	13. Tech Tricks & Tips for Concurrent Learning w/Art	17. PreK Support	16. Practical Classroom Practice/ Planning Live Supports Available
9:30		8. Kindergarten Centers		
10:00	5. Elementary Literacy Support	Office Hours w/ Science or Social Studies	11. Technology Hardware to Support Learning Q & A w/Kara	
10:30	6. Middle Literacy Support	Office Hours w/ Special Ed	Office Hours w/Kara	
11:00	10. Ready for More! Ideas for Teaching Special Education Students Concurrently (intermediate level) w/ Gray Consulting	14. Social Studies a Concurrent Format, 6-8	4. Math Instruction in a Concurrent Format 6-8	16. Practical Classroom Practice/ Planning Live Supports Available
11:30		1b. Science in a Concurrent Format, 6-8	2. Math Instruction in a Concurrent Format K-2	
12:00	12. Tech Tools to Support Concurrent Learning w/ Kara	Office Hours w/ Special Ed	3. Math Instruction in a Concurrent Format 3-5	
12:30	Office Hours w/Kara	1a. Science in a Concurrent Format, 1-5	7. Engaging English Learners Concurrently	

Monday 3/22				
3:30	11. Technology Hardware to Support Learning Q & A w/Art	5. Elementary Literacy Support	4. Math Instruction in a Concurrent Format 6-8	Data Office Hours w/Vero

	Content	Time	Grade Levels
1	a) 1-5 Science Investigations in a Concurrent Format, b) 6-8 Science Investigations in a Concurrent Format	30 Minutes	1-8
2	Math Instruction in a Concurrent Format	30 Minutes	K-2
3	Math Instruction in a Concurrent Format	30 Minutes	3-5
4	Math Instruction in a Concurrent Format	30 Minutes	6-8
5	Elementary Literacy Support	30 Minutes	K-4
6	Middle Literacy Support	30 Minutes	5-8
7	Engaging English Learners Concurrently	30 Minutes	K-8
8	Kindergarten Centers	30 Minutes	K
9	Getting Started! Ideas for Teaching Special Education Students Concurrently (beginner level) w/ Gray Consulting	60 Minutes	PK-8
10	Ready for More! Ideas for Teaching Special Education Students Concurrently (intermediate level) w/ Gray Consulting	60 Minutes	PK-8
11	Technology Hardware to Support Concurrent Learning Q & A	30 Minutes	PK-8

4:00	13. Tech Tricks & Tips for Concurrent Learning w/Vero	6. Middle Literacy Support	2. Math Instruction in a Concurrent Format K-2	Clever Office Hours w/Art
4:30	Office Hours w/Vero	7. Engaging English Learners Concurrently	3. Math Instruction in a Concurrent Format 3-5	13. Tech Tricks & Tips for Concurrent Learning w/Kara
5:00	11. Technology Hardware to Support Learning Q & A w/Kara	1a. Science in a Concurrent Format 1-5	Office Hours w/Math	Office Hours w/Melissa & Robin

Tuesday 3/23

3:30	7. Engaging English Learners Concurrently	17. PreK Support	2. Math Instruction in a Concurrent Format K-2	1b. Science in a Concurrent Format 6-8
4:00	11. Technology Hardware to Support Learning Q & A w/Kara		3. Math Instruction in a Concurrent Format 3-5	14. Social Studies in a Concurrent Format 6-8
4:30	11. Technology Hardware to Support Learning Q & A w/Art	9. Getting Started! Ideas for Teaching Special Education Students Concurrently (beginner level) w/ Gray Consulting	4. Math Instruction in a Concurrent Format 6-8	Office Hours w/Kara
5:00	13. Tech Tricks & Tips for Concurrent Learning w/Kara		Office Hours w/Math	Office Hours w/Science or Social Studies

Wednesday 3/24

3:30	Office Hours w/Math	8. Kindergarten Centers	Office Hours w/Special Ed	16. Practical Classroom Practice/
4:00	12. Tech Tools to Support Learning w/Kara	14. Social Studies a Concurrent Format, 6-8	Data Office Hours w/Vero	

12	Tech Tools to Support Concurrent Learning	30 Minutes	PK-8
13	Tech Tricks & Tips for Concurrent Learning	30 Minutes	PK-8
14	Social Studies Using an Online Program in a Concurrent Model	30 Minutes	6-8
15	PreK Support	1 Hour	PK
16	Practical Classroom Practice/Planning Live Supports Available	2 Hours	PK-8

4:30	17. PreK Support	5. Elementary Literacy Support	12. Tech Tools to Support Learning w/Kara	ractice/ Planning Live Supports Available
5:00		6. Middle Literacy Support	Clever Office Hours w/ Art	

Thursday 3/25				
3:30	5. Elementary Literacy Support	1a. Science in a Concurrent Format, 1-5	4. Math Instruction in a Concurrent Format 6-8	16. Practical Classroom ractice/ Planning Live Supports Available
4:00	10. Ready for More! Ideas for Teaching Special Education Students Concurrently (intermediate level) w/ Gray Consulting	1b. Science in a Concurrent Format, 6-8	2. Math Instruction in a Concurrent Format K-2	
4:30		7. Engaging English Learners Concurrently	3. Math Instruction in a Concurrent Format 3-5	
5:00	8. Kindergarten Centers	12. Tech Tools to Support Learning w/Kara	Office Hours w/ELD	

Appendix C

Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis

*Derek K Chu, Elie A Akl, Stephanie Duda, Karla Solo, Sally Yaacoub, Holger J Schünemann, on behalf of the COVID-19 Systematic Urgent Review Group Effort (SURGE) study authors**

Summary

Background Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causes COVID-19 and is spread person-to-person through close contact. We aimed to investigate the effects of physical distance, face masks, and eye protection on virus transmission in health-care and non-health-care (eg, community) settings.

Methods We did a systematic review and meta-analysis to investigate the optimum distance for avoiding person-to-person virus transmission and to assess the use of face masks and eye protection to prevent transmission of viruses. We obtained data for SARS-CoV-2 and the betacoronaviruses that cause severe acute respiratory syndrome, and Middle East respiratory syndrome from 21 standard WHO-specific and COVID-19-specific sources. We searched these data sources from database inception to May 3, 2020, with no restriction by language, for comparative studies and for contextual factors of acceptability, feasibility, resource use, and equity. We screened records, extracted data, and assessed risk of bias in duplicate. We did frequentist and Bayesian meta-analyses and random-effects meta-regressions. We rated the certainty of evidence according to Cochrane methods and the GRADE approach. This study is registered with PROSPERO, CRD42020177047.

Findings Our search identified 172 observational studies across 16 countries and six continents, with no randomised controlled trials and 44 relevant comparative studies in health-care and non-health-care settings (n=25 697 patients). Transmission of viruses was lower with physical distancing of 1 m or more, compared with a distance of less than 1 m (n=10 736, pooled adjusted odds ratio [aOR] 0·18, 95% CI 0·09 to 0·38; risk difference [RD] −10·2%, 95% CI −11·5 to −7·5; moderate certainty); protection was increased as distance was lengthened (change in relative risk [RR] 2·02 per m; $p_{interaction}$=0·041; moderate certainty). Face mask use could result in a large reduction in risk of infection (n=2647; aOR 0·15, 95% CI 0·07 to 0·34, RD −14·3%, −15·9 to −10·7; low certainty), with stronger associations with N95 or similar respirators compared with disposable surgical masks or similar (eg, reusable 12–16-layer cotton masks; $p_{interaction}$=0·090; posterior probability >95%, low certainty). Eye protection also was associated with less infection (n=3713; aOR 0·22, 95% CI 0·12 to 0·39, RD −10·6%, 95% CI −12·5 to −7·7; low certainty). Unadjusted studies and subgroup and sensitivity analyses showed similar findings.

Interpretation The findings of this systematic review and meta-analysis support physical distancing of 1 m or more and provide quantitative estimates for models and contact tracing to inform policy. Optimum use of face masks, respirators, and eye protection in public and health-care settings should be informed by these findings and contextual factors. Robust randomised trials are needed to better inform the evidence for these interventions, but this systematic appraisal of currently best available evidence might inform interim guidance.

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See Comment page 1950

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See Online for appendix

Introduction

As of May 28, 2020, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has infected more than 5·85 million individuals worldwide and caused more than 359 000 deaths.[1] Emergency lockdowns have been initiated in countries across the globe, and the effect on health, wellbeing, business, and other aspects of daily life are felt throughout societies and by individuals. With no effective pharmacological interventions or vaccine available in the imminent future, reducing the rate of infection (ie, flattening the curve) is a priority, and prevention of infection is the best approach to achieve this aim.

SARS-CoV-2 spreads person-to-person through close contact and causes COVID-19. It has not been solved if

Research in context

Evidence before this study

We searched 21 databases and resources from inception to May 3, 2020, with no restriction by language, for studies of any design evaluating physical distancing, face masks, and eye protection to prevent transmission of the viruses that cause COVID-19 and related diseases (eg, severe acute respiratory syndrome [SARS] and Middle East respiratory syndrome [MERS]) between infected individuals and people close to them (eg, household members, caregivers, and health-care workers). Previous related meta-analyses have focused on randomised trials and reported imprecise data for common respiratory viruses such as seasonal influenza, rather than the pandemic and epidemic betacoronaviruses causative of COVID-19 (severe acute respiratory syndrome coronavirus 2 [SARS-CoV-2]), SARS (SARS-CoV), or MERS (MERS-CoV). Other meta-analyses have focused on interventions in the health-care setting and have not included non-health-care (eg, community) settings. Our search did not retrieve any systematic review of information on physical distancing, face masks, or eye protection to prevent transmission of SARS-CoV-2, SARS-CoV, and MERS-CoV.

Added value of this study

We did a systematic review of 172 observational studies in health-care and non-health-care settings across 16 countries and six continents; 44 comparative studies were included in a meta-analysis, including 25 697 patients with COVID-19, SARS, or MERS. Our findings are, to the best of our knowledge, the first to rapidly synthesise all direct information on COVID-19 and, therefore, provide the best available evidence to inform optimum use of three common and simple interventions to help reduce the rate of infection and inform non-pharmaceutical interventions, including pandemic mitigation in non-health-care settings. Physical distancing of 1 m or more was associated with a much lower risk of infection, as was use of face masks (including N95 respirators or similar and surgical or similar masks [eg, 12–16-layer cotton or gauze masks]) and eye protection (eg, goggles or face shields). Added benefits are likely with even larger physical distances (eg, 2 m or more based on modelling) and might be present with N95 or similar respirators versus medical masks or similar. Across 24 studies in health-care and non-health-care settings of contextual factors to consider when formulating recommendations, most stakeholders found these personal protection strategies acceptable, feasible, and reassuring but noted harms and contextual challenges, including frequent discomfort and facial skin breakdown, high resource use linked with the potential to decrease equity, increased difficulty communicating clearly, and perceived reduced empathy of care providers by those they were caring for.

Implications of all the available evidence

In view of inconsistent guidelines by various organisations based on limited information, our findings provide some clarification and have implications for multiple stakeholders. The risk for infection is highly dependent on distance to the individual infected and the type of face mask and eye protection worn. From a policy and public health perspective, current policies of at least 1 m physical distancing seem to be strongly associated with a large protective effect, and distances of 2 m could be more effective. These data could also facilitate harmonisation of the definition of exposed (eg, within 2 m), which has implications for contact tracing. The quantitative estimates provided here should inform disease-modelling studies, which are important for planning pandemic response efforts. Policy makers around the world should strive to promptly and adequately address equity implications for groups with currently limited access to face masks and eye protection. For health-care workers and administrators, our findings suggest that N95 respirators might be more strongly associated with protection from viral transmission than surgical masks. Both N95 and surgical masks have a stronger association with protection compared with single-layer masks. Eye protection might also add substantial protection. For the general public, evidence shows that physical distancing of more than 1 m is highly effective and that face masks are associated with protection, even in non-health-care settings, with either disposable surgical masks or reusable 12–16-layer cotton ones, although much of this evidence was on mask use within households and among contacts of cases. Eye protection is typically underconsidered and can be effective in community settings. However, no intervention, even when properly used, was associated with complete protection from infection. Other basic measures (eg, hand hygiene) are still needed in addition to physical distancing and use of face masks and eye protection.

SARS-CoV-2 might spread through aerosols from respiratory droplets; so far, air sampling has found virus RNA in some studies[2–4] but not in others.[5–8] However, finding RNA virus is not necessarily indicative of replication-competent and infection-competent (viable) virus that could be transmissible. The distance from a patient that the virus is infective, and the optimum person-to-person physical distance, is uncertain. For the currently foreseeable future (ie, until a safe and effective vaccine or treatment becomes available), COVID-19 prevention will continue to rely on non-pharmaceutical interventions, including pandemic mitigation in community settings.[9] Thus, quantitative assessment of physical distancing is relevant to inform safe interaction and care of patients with SARS-CoV-2 in both health-care and non-health-care settings. The definition of close contact or potentially exposed helps to risk stratify, contact trace, and develop guidance documents, but these definitions differ around the globe.

To contain widespread infection and to reduce morbidity and mortality among health-care workers and others in contact with potentially infected people, jurisdictions have issued conflicting advice about physical or social distancing. Use of face masks with or

without eye protection to achieve additional protection is debated in the mainstream media and by public health authorities, in particular the use of face masks for the general population;[10] moreover, optimum use of face masks in health-care settings, which have been used for decades for infection prevention, is facing challenges amid personal protective equipment (PPE) shortages.[11]

Any recommendations about social or physical distancing, and the use of face masks, should be based on the best available evidence. Evidence has been reviewed for other respiratory viral infections, mainly seasonal influenza,[12,13] but no comprehensive review is available of information on SARS-CoV-2 or related betacoronaviruses that have caused epidemics, such as severe acute respiratory syndrome (SARS) or Middle East respiratory syndrome (MERS). We, therefore, systematically reviewed the effect of physical distance, face masks, and eye protection on transmission of SARS-CoV-2, SARS-CoV, and MERS-CoV.

Methods

Search strategy and selection criteria

To inform WHO guidance documents, on March 25, 2020, we did a rapid systematic review.[14] We created a large international collaborative and we used Cochrane methods[15] and the GRADE approach.[16] We prospectively submitted the systematic review protocol for registration on PROSPERO (CRD42020177047; appendix pp 23–29). We have followed PRISMA[17] and MOOSE[18] reporting guidelines (appendix pp 30–33).

From database inception to May 3, 2020, we searched for studies of any design and in any setting that included patients with WHO-defined confirmed or probable COVID-19, SARS, or MERS, and people in close contact with them, comparing distances between people and COVID-19 infected patients of 1 m or larger with smaller distances, with or without a face mask on the patient, or with or without a face mask, eye protection, or both on the exposed individual. The aim of our systematic review was for quantitative assessment to ascertain the physical distance associated with reduced risk of acquiring infection when caring for an individual infected with SARS-CoV-2, SARS-CoV, or MERS-CoV. Our definition of face masks included surgical masks and N95 respirators, among others; eye protection included visors, faceshields, and goggles, among others.

We searched (up to March 26, 2020) MEDLINE (using the Ovid platform), PubMed, Embase, CINAHL (using the Ovid platform), the Cochrane Library, COVID-19 Open Research Dataset Challenge, COVID-19 Research Database (WHO), Epistemonikos (for relevant systematic reviews addressing MERS and SARS, and its COVID-19 Living Overview of the Evidence platform), EPPI Centre living systematic map of the evidence, ClinicalTrials.gov, WHO International Clinical Trials Registry Platform, relevant documents on the websites of governmental and other relevant organisations, reference lists of included papers, and relevant systematic reviews.[19,20] We handsearched (up to May 3, 2020) preprint servers (bioRxiv, medRxiv, and Social Science Research Network First Look) and coronavirus resource centres of *The Lancet*, *JAMA*, and *N Engl J Med* (appendix pp 3–5). We did not limit our search by language. We initially could not obtain three full texts for evaluation, but we obtained them through interlibrary loan or contacting a study author. We did not restrict our search to any quantitative cutoff for distance.

Data collection

We screened titles and abstracts, reviewed full texts, extracted data, and assessed risk of bias by two authors and independently, using standardised prepiloted forms (Covidence; Veritas Health Innovation, Melbourne, VIC, Australia), and we cross-checked screening results using artificial intelligence (Evidence Prime, Hamilton, ON, Canada). We resolved disagreements by consensus. We extracted data for study identifier, study design, setting, population characteristics, intervention and comparator characteristics, quantitative outcomes, source of funding

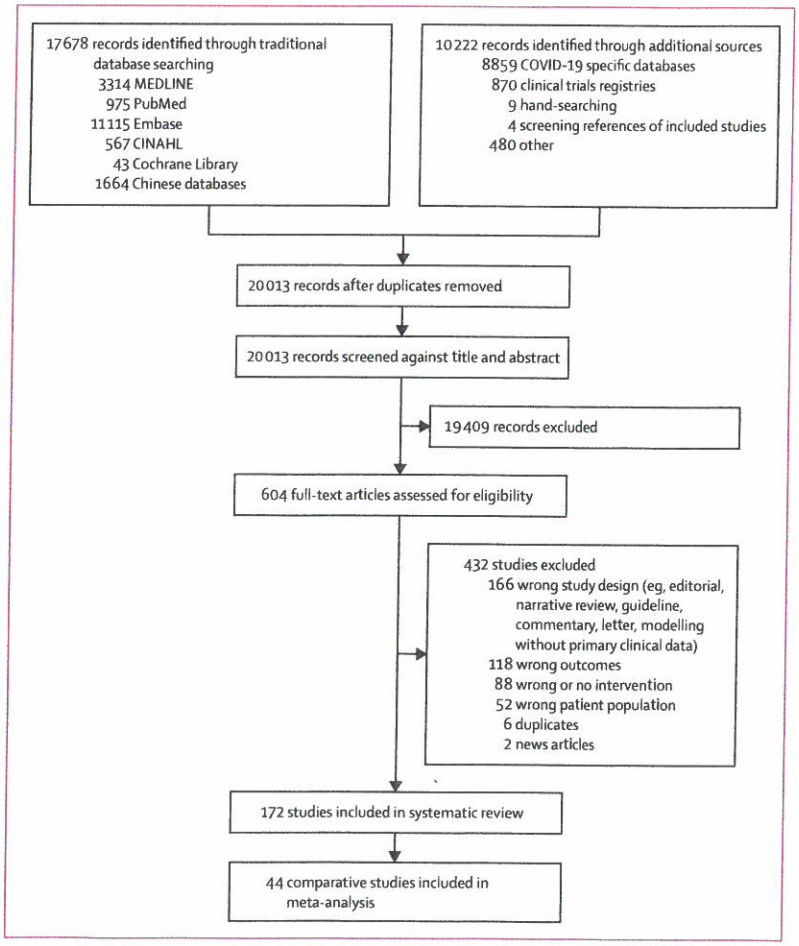


Figure 1: **Study selection**

	Population size (n)	Country	Setting	Disease caused by virus	Case definition (WHO)	Adjusted estimates	Risk of bias*
Alraddadi et al (2016)[34]	283	Saudi Arabia	Health care	MERS	Confirmed	Yes	********
Arwady et al (2016)[35]	79	Saudi Arabia	Non-health care (household and family contacts)	MERS	Confirmed	No	******
Bai et al (2020)[36]	118	China	Health care	COVID-19	Confirmed	No	*****
Burke et al (2020)[37]	338	USA	Health care and non-health care (including household and community)	COVID-19	Confirmed	No	****
Caputo et al (2006)[38]	33	Canada	Health care	SARS	Confirmed	No	*****
Chen et al (2009)[39]	758	China	Health care	SARS	Confirmed	Yes	*******
Cheng et al (2020)[40]	226	China	Non-health care (household and family contacts)	COVID-19	Confirmed	No	******
Ha et al (2004)[42]	117	Vietnam	Health care	SARS	Confirmed	No	**
Hall et al (2014)[43]	48	Saudi Arabia	Health care	MERS	Confirmed	No	***
Heinzerling et al (2020)[44]	37	USA	Health care	COVID-19	Confirmed	No	****
Ho et al (2004)[45]	372	Taiwan	Health care	SARS	Confirmed	No	********
Ki et al (2019)[47]	446	South Korea	Health care	MERS	Confirmed	No	******
Kim et al (2016)[48]	9	South Korea	Health care	MERS	Confirmed	No	*****
Kim et al (2016)[49]	1169	South Korea	Health care	MERS	Confirmed	No	******
Lau et al (2004)[50]	2270	China	Non-health care (households)	SARS	Probable	Yes	******
Liu et al (2009)[51]	477	China	Health care	SARS	Confirmed	Yes	*****
Liu et al (2020)[52]	20	China	Non-health care (close contacts)	COVID-19	Confirmed	No	*******
Loeb et al (2004)[53]	43	Canada	Health care	SARS	Confirmed	No	**
Ma et al (2004)[54]	426	China	Health care	SARS	Confirmed	Yes	*********
Nishiura et al (2005)[55]	115	Vietnam	Health care	SARS	Confirmed	Yes	********
Nishiyama et al (2008)[56]	146	Vietnam	Health care	SARS	Confirmed	Yes	******
Olsen et al (2003)[57]	304	China	Non-health care (airplane)	SARS	Confirmed	No	******
Park et al (2004)[58]	110	USA	Health care	SARS	Confirmed	No	**********
Park et al (2016)[59]	80	South Korea	Health care	MERS	Confirmed and probable	No	***
Peck et al (2004)[60]	26	USA	Health care	SARS	Confirmed	No	*********
Pei et al (2006)[61]	443	China	Health care	SARS	Confirmed	No	********
Rea et al (2007)[62]	8662	Canada	Non-health care (community contacts)	SARS	Probable	No	****
Reuss et al (2014)[63]	81	Germany	Health care	MERS	Confirmed	No	*****
Reynolds et al (2006)[64]	153	Vietnam	Health care	SARS	Confirmed	No	***
Ryu et al (2019)[65]	34	South Korea	Health care	MERS	Confirmed	No	******
Scales et al (2003)[66]	69	Canada	Health care	SARS	Probable	No	**
Seto et al (2003)[67]	254	China	Health care	SARS	Confirmed	Yes	********
Teleman et al (2004)[68]	86	Singapore	Health care	SARS	Confirmed	Yes	********
Tuan et al (2007)[69]	212	Vietnam	Non-health care (household and community contacts)	SARS	Confirmed	Yes	******
Van Kerkhove et al (2019)[46]	828	Saudi Arabia	Non-health care (dormitory)	MERS	Confirmed	Yes	********
Wang et al (2020)[41]	493	China	Health care	COVID-19	Confirmed	Yes	****

(Table 1 continues on next page)

	n	Country	Setting	Disease caused by virus	Case definition (WHO)	Adjusted estimates	Risk of bias*
(Continued from previous page)							
Wang et al (2020)[70]	5442	China	Health care	COVID-19	Confirmed	No	*****
Wiboonchutikul et al (2016)[71]	38	Thailand	Health care	MERS	Confirmed	No	*****
Wilder-Smith et al (2005)[72]	80	Singapore	Health care	SARS	Confirmed	No	********
Wong et al (2004)[73]	66	China	Health care	SARS	Confirmed	No	*****
Wu et al (2004)[74]	375	China	Non-health care (community)	SARS	Confirmed	Yes	********
Yin et al (2004)[75]	257	China	Health care	SARS	Confirmed	Yes	******
Yu et al (2005)[76]	74	China	Health care	SARS	Confirmed	No	*******
Yu et al (2007)[77]	124 wards	China	Health care	SARS	Confirmed	Yes	*******

Across studies, mean age was 30–60 years. SARS=severe acute respiratory syndrome. MERS=Middle East respiratory syndrome. *The Newcastle-Ottawa Scale was used for the risk of bias assessment, with more stars equalling lower risk.

Table 1: **Characteristics of included comparative studies**

and reported conflicts of interests, ethics approval, study limitations, and other important comments.

Outcomes

Outcomes of interest were risk of transmission (ie, WHO-defined confirmed or probable COVID-19, SARS, or MERS) to people in health-care or non-health-care settings by those infected; hospitalisation; intensive care unit admission; death; time to recovery; adverse effects of interventions; and contextual factors such as acceptability, feasibility, effect on equity, and resource considerations related to the interventions of interest. However, data were only available to analyse intervention effects for transmission and contextual factors. Consistent with WHO, studies generally defined confirmed cases with laboratory confirmation (with or without symptoms) and probable cases with clinical evidence of the respective infection (ie, suspected to be infected) but for whom confirmatory testing either had not yet been done for any reason or was inconclusive.

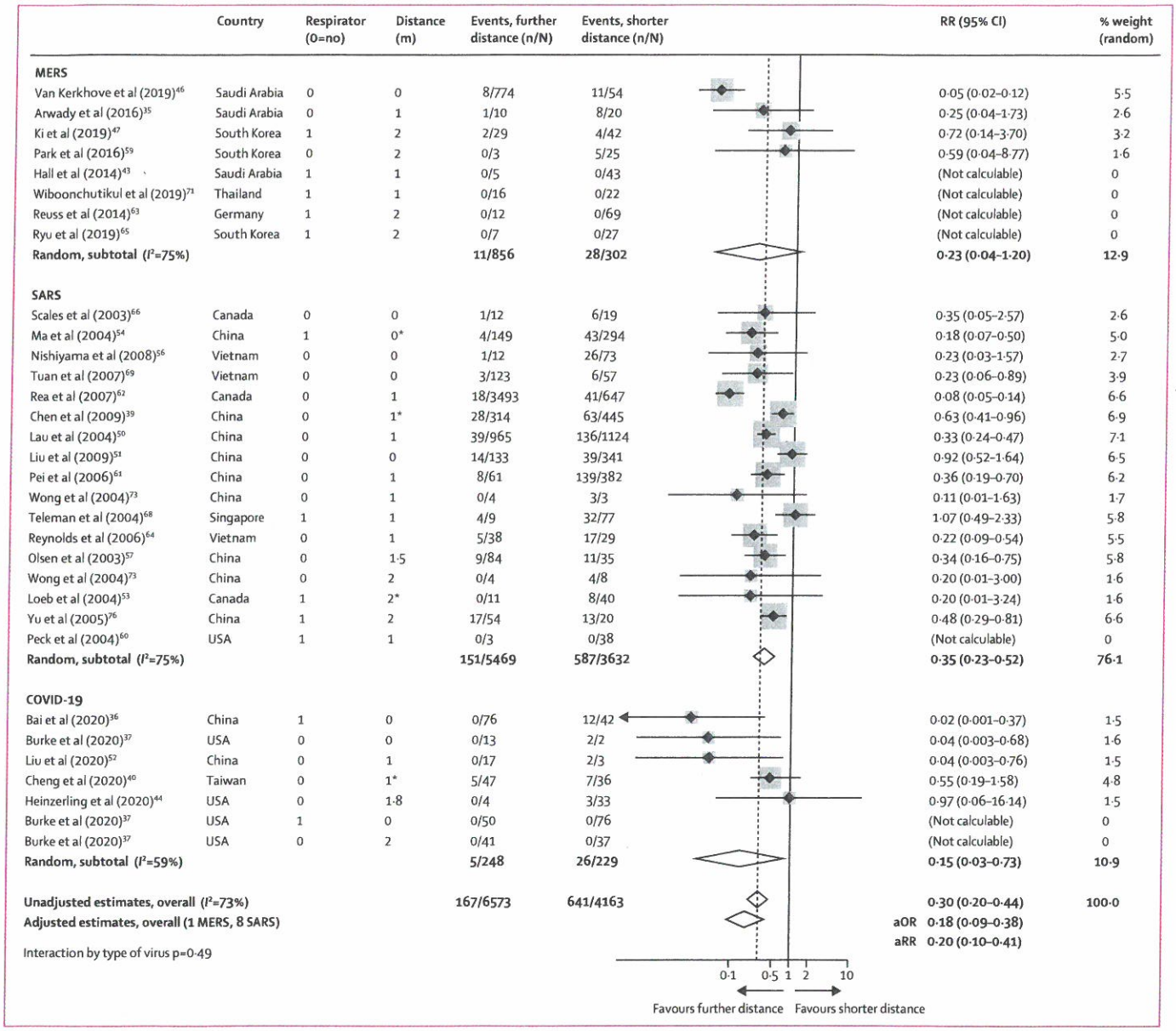
Data analysis

Our search did not identify any randomised trials of COVID-19, SARS, or MERS. We did a meta-analysis of associations by pooling risk ratios (RRs) or adjusted odds ratios (aORs) depending on availability of these data from observational studies, using DerSimonian and Laird random-effects models. We adjusted for variables including age, sex, and severity of source case; these variables were not the same across studies. Because between-study heterogeneity can be misleadingly large when quantified by I^2 during meta-analysis of observational studies,[21,22] we used GRADE guidance to assess between-study heterogeneity.[21] Throughout, we present RRs as unadjusted estimates and aORs as adjusted estimates.

We used the Newcastle-Ottawa scale to rate risk of bias for comparative non-randomised studies corresponding to every study's design (cohort or case-control).[23,24] We planned to use the Cochrane Risk of Bias tool 2.0 for randomised trials,[25] but our search did not identify any eligible randomised trials. We synthesised data in both narrative and tabular formats. We graded the certainty of evidence using the GRADE approach. We used the GRADEpro app to rate evidence and present it in GRADE evidence profiles and summary of findings tables[26,27] using standardised terms.[28,29]

For more on the **GRADEpro app** see https://www.gradepro.org

We analysed data for subgroup effects by virus type, intervention (different distances or face mask types), and setting (health care *vs* non-health care). Among the studies assessing physical distancing measures to prevent viral transmission, the intervention varied (eg, direct physical contact [0 m], 1 m, or 2 m). We, therefore, analysed the effect of distance on the size of the associations by random-effects univariate meta-regressions, using restricted maximum likelihood, and we present mean effects and 95% CIs. We calculated tests for interaction using a minimum of 10 000 Monte Carlo random permutations to avoid spurious findings.[30] We formally assessed the credibility of potential effect-modifiers using GRADE guidance.[21] We did two sensitivity analyses to test the robustness of our findings. First, we used Bayesian meta-analyses to reinterpret the included studies considering priors derived from the effect point estimate and variance from a meta-analysis of ten randomised trials evaluating face mask use versus no face mask use to prevent influenza-like illness in health-care workers.[31] Second, we used Bayesian meta-analyses to reinterpret the efficacy of N95 respirators versus medical masks on preventing influenza-like illness after seasonal viral (mostly influenza) infection.[13] For these sensitivity analyses, we used hybrid Metropolis-Hastings and Gibbs sampling, a 10 000 sample burn-in, 40 000 Markov chain Monte Carlo samples, and we tested non-informative and sceptical priors (eg, four time variance)[32,33] to inform



	Country	Respirator (0=no)	Distance (m)	Events, further distance (n/N)	Events, shorter distance (n/N)	RR (95% CI)	% weight (random)
MERS							
Van Kerkhove et al (2019)[46]	Saudi Arabia	0	0	8/774	11/54	0·05 (0·02–0·12)	5·5
Arwady et al (2016)[35]	Saudi Arabia	0	1	1/10	8/20	0·25 (0·04–1·73)	2·6
Ki et al (2019)[47]	South Korea	1	2	2/29	4/42	0·72 (0·14–3·70)	3·2
Park et al (2016)[59]	South Korea	0	2	0/3	5/25	0·59 (0·04–8·77)	1·6
Hall et al (2014)[43]	Saudi Arabia	1	1	0/5	0/43	(Not calculable)	0
Wiboonchutikul et al (2019)[71]	Thailand	1	1	0/16	0/22	(Not calculable)	0
Reuss et al (2014)[63]	Germany	1	2	0/12	0/69	(Not calculable)	0
Ryu et al (2019)[65]	South Korea	1	2	0/7	0/27	(Not calculable)	0
Random, subtotal (I^2=75%)				**11/856**	**28/302**	**0·23 (0·04–1·20)**	**12·9**
SARS							
Scales et al (2003)[66]	Canada	0	0	1/12	6/19	0·35 (0·05–2·57)	2·6
Ma et al (2004)[54]	China	1	0*	4/149	43/294	0·18 (0·07–0·50)	5·0
Nishiyama et al (2008)[56]	Vietnam	0	0	1/12	26/73	0·23 (0·03–1·57)	2·7
Tuan et al (2007)[69]	Vietnam	0	0	3/123	6/57	0·23 (0·06–0·89)	3·9
Rea et al (2007)[62]	Canada	0	1	18/3493	41/647	0·08 (0·05–0·14)	6·6
Chen et al (2009)[39]	China	0	1*	28/314	63/445	0·63 (0·41–0·96)	6·9
Lau et al (2004)[50]	China	0	1	39/965	136/1124	0·33 (0·24–0·47)	7·1
Liu et al (2009)[51]	China	0	0	14/133	39/341	0·92 (0·52–1·64)	6·5
Pei et al (2006)[61]	China	0	1	8/61	139/382	0·36 (0·19–0·70)	6·2
Wong et al (2004)[73]	China	0	1	0/4	3/3	0·11 (0·01–1·63)	1·7
Teleman et al (2004)[68]	Singapore	1	1	4/9	32/77	1·07 (0·49–2·33)	5·8
Reynolds et al (2006)[64]	Vietnam	0	1	5/38	17/29	0·22 (0·09–0·54)	5·5
Olsen et al (2003)[57]	China	0	1·5	9/84	11/35	0·34 (0·16–0·75)	5·8
Wong et al (2004)[73]	China	0	2	0/4	4/8	0·20 (0·01–3·00)	1·6
Loeb et al (2004)[53]	Canada	1	2*	0/11	8/40	0·20 (0·01–3·24)	1·6
Yu et al (2005)[76]	China	1	2	17/54	13/20	0·48 (0·29–0·81)	6·6
Peck et al (2004)[60]	USA	1	1	0/3	0/38	(Not calculable)	0
Random, subtotal (I^2=75%)				**151/5469**	**587/3632**	**0·35 (0·23–0·52)**	**76·1**
COVID-19							
Bai et al (2020)[36]	China	1	0	0/76	12/42	0·02 (0·001–0·37)	1·5
Burke et al (2020)[37]	USA	0	0	0/13	2/2	0·04 (0·003–0·68)	1·6
Liu et al (2020)[52]	China	0	1	0/17	2/3	0·04 (0·003–0·76)	1·5
Cheng et al (2020)[40]	Taiwan	0	1*	5/47	7/36	0·55 (0·19–1·58)	4·8
Heinzerling et al (2020)[44]	USA	0	1·8	0/4	3/33	0·97 (0·06–16·14)	1·5
Burke et al (2020)[37]	USA	1	0	0/50	0/76	(Not calculable)	0
Burke et al (2020)[37]	USA	0	2	0/41	0/37	(Not calculable)	0
Random, subtotal (I^2=59%)				**5/248**	**26/229**	**0·15 (0·03–0·73)**	**10·9**
Unadjusted estimates, overall (I^2=73%)				**167/6573**	**641/4163**	**0·30 (0·20–0·44)**	**100·0**
Adjusted estimates, overall (1 MERS, 8 SARS)						**aOR 0·18 (0·09–0·38)**	
						aRR 0·20 (0·10–0·41)	
Interaction by type of virus p=0·49							

Figure 2: **Forest plot showing the association of COVID-19, SARS, or MERS exposure proximity with infection**
SARS=severe acute respiratory syndrome. MERS=Middle East respiratory syndrome. RR=relative risk. aOR=adjusted odds ratio. aRR=adjusted relative risk. *Estimated values; sensitivity analyses excluding these values did not meaningfully alter findings.

mean estimates of effect, 95% credibility intervals (CrIs), and posterior distributions. We used non-informative hyperpriors to estimate statistical heterogeneity. Model convergence was confirmed in all cases with good mixing in visual inspection of trace plots, autocorrelation plots, histograms, and kernel density estimates in all scenarios. Parameters were blocked, leading to acceptance of approximately 50% and efficiency greater than 1% in all cases (typically about 40%). We did analyses using Stata version 14.3.

Role of the funding source

The funder contributed to defining the scope of the review but otherwise had no role in study design and data collection. Data were interpreted and the report drafted and submitted without funder input, but according to contractual agreement, the funder provided review at the time of final publication. The corresponding author had full access to all data in the study and had final responsibility for the decision to submit for publication.

	Studies and participants	Relative effect (95% CI)	Anticipated absolute effect (95% CI), eg, chance of viral infection or transmission		Difference (95% CI)	Certainty*	What happens (standardised GRADE terminology)[29]
			Comparison group	Intervention group			
Physical distance ≥1 m *vs* <1 m	Nine adjusted studies (n=7782); 29 unadjusted studies (n=10 736)	aOR 0·18 (0·09 to 0·38); unadjusted RR 0·30 (95% CI 0·20 to 0·44)	Shorter distance, 12·8%	Further distance, 2·6% (1·3 to 5·3)	−10·2% (−11·5 to −7·5)	Moderate†	A physical distance of more than 1 m probably results in a large reduction in virus infection; for every 1 m further away in distancing, the relative effect might increase 2·02 times
Face mask *vs* no face mask	Ten adjusted studies (n=2647); 29 unadjusted studies (n=10 170)	aOR 0·15 (0·07 to 0·34); unadjusted RR 0·34 (95% CI 0·26 to 0·45)	No face mask, 17·4%	Face mask, 3·1% (1·5 to 6·7)	−14·3% (−15·9 to −10·7)	Low‡	Medical or surgical face masks might result in a large reduction in virus infection; N95 respirators might be associated with a larger reduction in risk compared with surgical or similar masks§
Eye protection (faceshield, goggles) *vs* no eye protection	13 unadjusted studies (n=3713)	Unadjusted RR 0·34 (0·22 to 0·52)¶	No eye protection, 16·0%	Eye protection, 5·5% (3·6 to 8·5)	−10·6% (−12·5 to −7·7)	Low‖	Eye protection might result in a large reduction in virus infection

Table based on GRADE approach.[26–29] Population comprised people possibly exposed to individuals infected with SARS-CoV-2, SARS-CoV, or MERS-CoV. Setting was any health-care or non-health-care setting. Outcomes were infection (laboratory-confirmed or probable) and contextual factors. Risk (95% CI) in intervention group is based on assumed risk in comparison group and relative effect (95% CI) of the intervention. All studies were non-randomised and evaluated using the Newcastle-Ottawa Scale; some studies had a higher risk of bias than did others but no important difference was noted in sensitivity analyses excluding studies at higher risk of bias; we did not further rate down for risk of bias. Although there was a high I^2 value (which can be exaggerated in non-randomised studies)[71] and no overlapping CIs, point estimates generally exceeded the thresholds for large effects and we did not rate down for inconsistency. We did not rate down for indirectness for the association between distance and infection because SARS-CoV-2, SARS-CoV, and MERS-CoV all belong to the same family and have each caused epidemics with sufficient similarity; there was also no convincing statistical evidence of effect-modification across viruses; some studies also used bundled interventions but the studies include only those that provide adjusted estimates. aOR=adjusted odds ratio. RR=relative risk. SARS-CoV-2=severe acute respiratory syndrome coronavirus 2. SARS-CoV=severe acute respiratory syndrome coronavirus. MERS-CoV=Middle East respiratory syndrome coronavirus. *GRADE category of evidence; high certainty (we are very confident that the true effect lies close to that of the estimate of the effect); moderate certainty (we are moderately confident in the effect estimate; the true effect is probably close to the estimate, but it is possibly substantially different); low certainty (our confidence in the effect estimate is limited; the true effect could be substantially different from the estimate of the effect); very low certainty (we have very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect). †The effect is very large considering the thresholds set by GRADE, particularly at plausible levels of baseline risk, which also mitigated concerns about risk of bias; data also suggest a dose–response gradient, with associations increasing from smaller distances to 2 m and beyond, by meta-regression; we did not rate up for this domain alone but it further supports the decision to rate up in combination with the large effects. ‡The effect was very large, and the certainty of evidence could be rated up, but we made a conservative decision not to because of some inconsistency and risk of bias; hence, although the effect is qualitatively highly certain, the precise quantitative effect is low certainty. §In a subgroup analysis comparing N95 respirators with surgical or similar masks (eg, 12–16-layer cotton), the association was more pronounced in the N95 group (aOR 0·04, 95% CI 0·004–0·30) compared with other masks (0·33, 0·17–0·61; $p_{interaction}$=0·090); there was also support for effect-modification by formal analysis of subgroup credibility. ¶Two studies[54,75] provided adjusted estimates with n=295 in the eye protection group and n=406 in the group not wearing eye protection; results were similar to the unadjusted estimate (aOR 0·22, 95% CI 0·12–0·39). ‖The effect is large considering the thresholds set by GRADE assuming that ORs translate into similar magnitudes of RR estimates; this mitigates concerns about risk of bias, but we conservatively decided not to rate up for large or very large effects.

Table 2: **GRADE summary of findings**

Results

We identified 172 studies for our systematic review from 16 countries across six continents (figure 1; appendix pp 6–14, 41–47). Studies were all observational in nature; no randomised trials were identified of any interventions that directly addressed the included study populations. Of the 172 studies, 66 focused on how far a virus can travel by comparing the association of different distances on virus transmission to people (appendix pp 42–44). Of these 66 studies, five were mechanistic, assessing viral RNA, virions, or both cultured from the environment of an infected patient (appendix p 45).

44 studies were comparative[34–77] and fulfilled criteria for our meta-analysis (n=25 697; figure 1; table 1). We used these studies rather than case series and qualitative studies (appendix pp 41–47) to inform estimates of effect. 30 studies[34,37,41–45,47–51,53–56,58–61,64–70,72,74,75] focused on the association between use of various types of face masks and respirators by health-care workers, patients, or both with virus transmission. 13 studies[34,37–39,47,49,51,54,58,60,61,65,75] addressed the association of eye protection with virus transmission.

Some direct evidence was available for COVID-19 (64 studies, of which seven were comparative in design),[36,37,40,41,44,52,70] but most studies reported on SARS (n=55) or MERS (n=25; appendix pp 6–12). Of the 44 comparative studies, 40 included WHO-defined confirmed cases, one included both confirmed and probable cases, and the remaining three studies included probable cases. There was no effect-modification by case-definition (distance $p_{interaction}$=0·41; mask $p_{interaction}$=0·46; all cases for eye protection were confirmed). Most studies reported on bundled interventions, including different components of PPE and distancing, which was usually addressed by statistical adjustment. The included studies all occurred during recurrent or novel outbreak settings of COVID-19, SARS, or MERS.

Risk of bias was generally low-to-moderate after considering the observational designs (table 1), but both within studies and across studies the overall findings were similar between adjusted and unadjusted estimates. We did not detect strong evidence of publication bias in the body of evidence for any intervention (appendix pp 15–18). As we did not use case series data to inform estimates of effect of each intervention, we did not systematically rate risk of bias of these data. Therefore, we report further only those studies with comparative data.

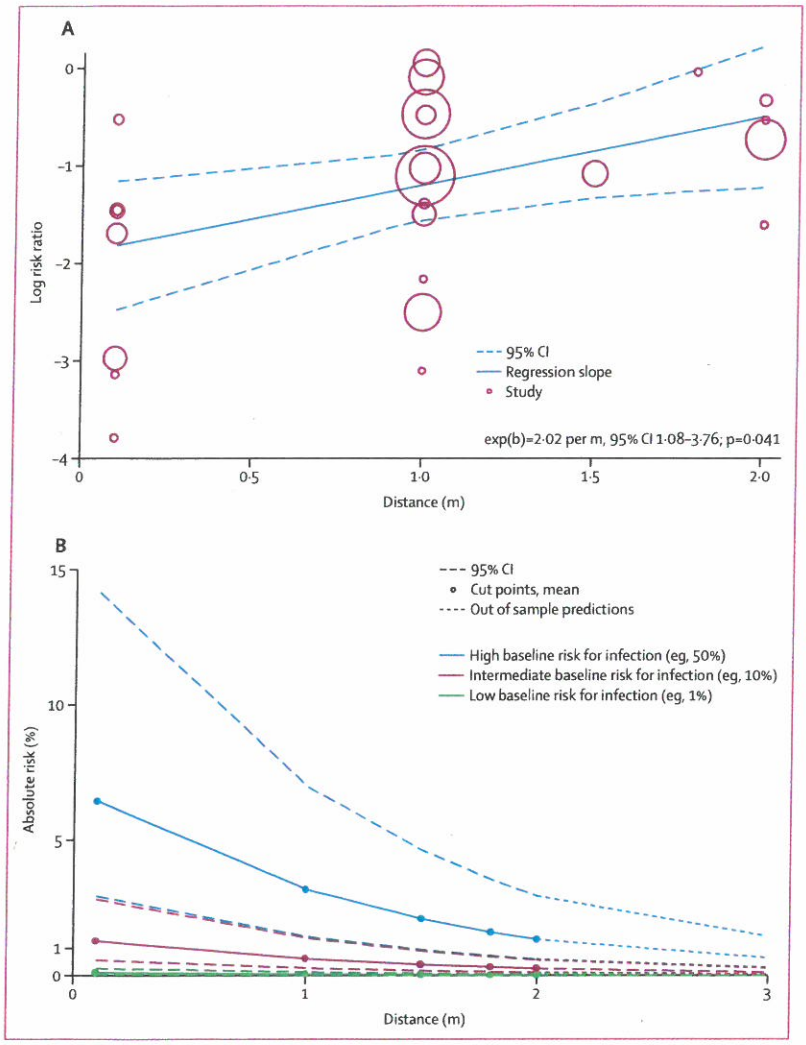


Figure 3: **Change in relative risk with increasing distance and absolute risk with increasing distance**
Meta-regression of change in relative risk with increasing distance from an infected individual (A). Absolute risk of transmission from an individual infected with SARS-CoV-2, SARS-CoV, or MERS-CoV with varying baseline risk and increasing distance (B). SARS-CoV-2=severe acute respiratory syndrome coronavirus 2. SARS-CoV=severe acute respiratory syndrome coronavirus. MERS-CoV=Middle East respiratory syndrome coronavirus.

Across 29 unadjusted and nine adjusted studies,[35–37,39,40,43,44,46,47,50–54,56,57,59–66,68,69,71,73,76] a strong association was found of proximity of the exposed individual with the risk of infection (unadjusted n=10736, RR 0·30, 95% CI 0·20 to 0·44; adjusted n=7782, aOR 0·18, 95% CI 0·09 to 0·38; absolute risk [AR] 12·8% with shorter distance *vs* 2·6% with further distance, risk difference [RD] −10·2%, 95% CI −11·5 to −7·5; moderate certainty; figure 2; table 2; appendix p 16). Although there were six studies on COVID-19, the association was seen irrespective of causative virus ($p_{interaction}$=0·49), health-care setting versus non-health-care setting ($p_{interaction}$=0·14), and by type of face mask ($p_{interaction}$=0·95; appendix pp 17, 19). However, different studies used different distances for the intervention. By meta-regression, the strength of association was larger with increasing distance (2·02 change in RR per m, 95% CI 1·08 to 3·76; $p_{interaction}$=0·041; moderate credibility subgroup effect; figure 3A; table 2). AR values with increasing distance given different degrees of baseline risk are shown in figure 3B, with potential values at 3 m also shown.

Across 29 unadjusted studies and ten adjusted studies,[34,37,41–45,47–51,53–56,58–61,64–70,72,74,75] the use of both N95 or similar respirators or face masks (eg, disposable surgical masks or similar reusable 12–16-layer cotton masks) by those exposed to infected individuals was associated with a large reduction in risk of infection (unadjusted n=10170, RR 0·34, 95% CI 0·26 to 0·45; adjusted studies n=2647, aOR 0·15, 95% CI 0·07 to 0·34; AR 3·1% with face mask *vs* 17·4% with no face mask, RD −14·3%, 95% CI −15·9 to −10·7; low certainty; figure 4; table 2; appendix pp 16, 18) with stronger associations in health-care settings (RR 0·30, 95% CI 0·22 to 0·41) compared with non-health-care settings (RR 0·56, 95% CI 0·40 to 0·79; $p_{interaction}$=0·049; low-to-moderate credibility for subgroup effect; figure 4; appendix p 19). When differential N95 or similar respirator use, which was more frequent in health-care settings than in non-health-care settings, was adjusted for the possibility that face masks were less effective in non-health-care settings, the subgroup effect was slightly less credible ($p_{interaction}$=0·11, adjusted for differential respirator use; figure 4). Indeed, the association with protection from infection was more pronounced with N95 or similar respirators (aOR 0·04, 95% CI 0·004 to 0·30) compared with other masks (aOR 0·33, 95% CI 0·17 to 0·61; $p_{interaction}$=0·090; moderate credibility subgroup effect; figure 5). The interaction was also seen when additionally adjusting for three studies that clearly reported aerosol-generating procedures ($p_{interaction}$=0·048; figure 5). Supportive evidence for this interaction was also seen in within-study comparisons (eg, N95 had a stronger protective association compared with surgical masks or 12–16-layer cotton masks); both N95 and surgical masks also had a stronger association with protection versus single-layer masks.[38,39,51,53,54,61,66,67,75]

We did a sensitivity analysis to test the robustness of our findings and to integrate all available information on face mask treatment effects for protection from COVID-19. We reconsidered our findings using random-effects Bayesian meta-analysis. Although non-informative priors showed similar results to frequentist approaches (aOR 0·16, 95% CrI 0·04–0·40), even using informative priors from the most recent meta-analysis on the effectiveness of masks versus no masks to prevent influenza-like illness (RR 0·93, 95% CI 0·83–1·05)[31] yielded a significant association with protection from COVID-19 (aOR 0·40, 95% CrI 0·16–0·97; posterior probability for RR <1, 98%). Minimally informing (25% influence with or without four-fold smaller mean effect size) the most recent and rigorous meta-analysis of the effectiveness of N95

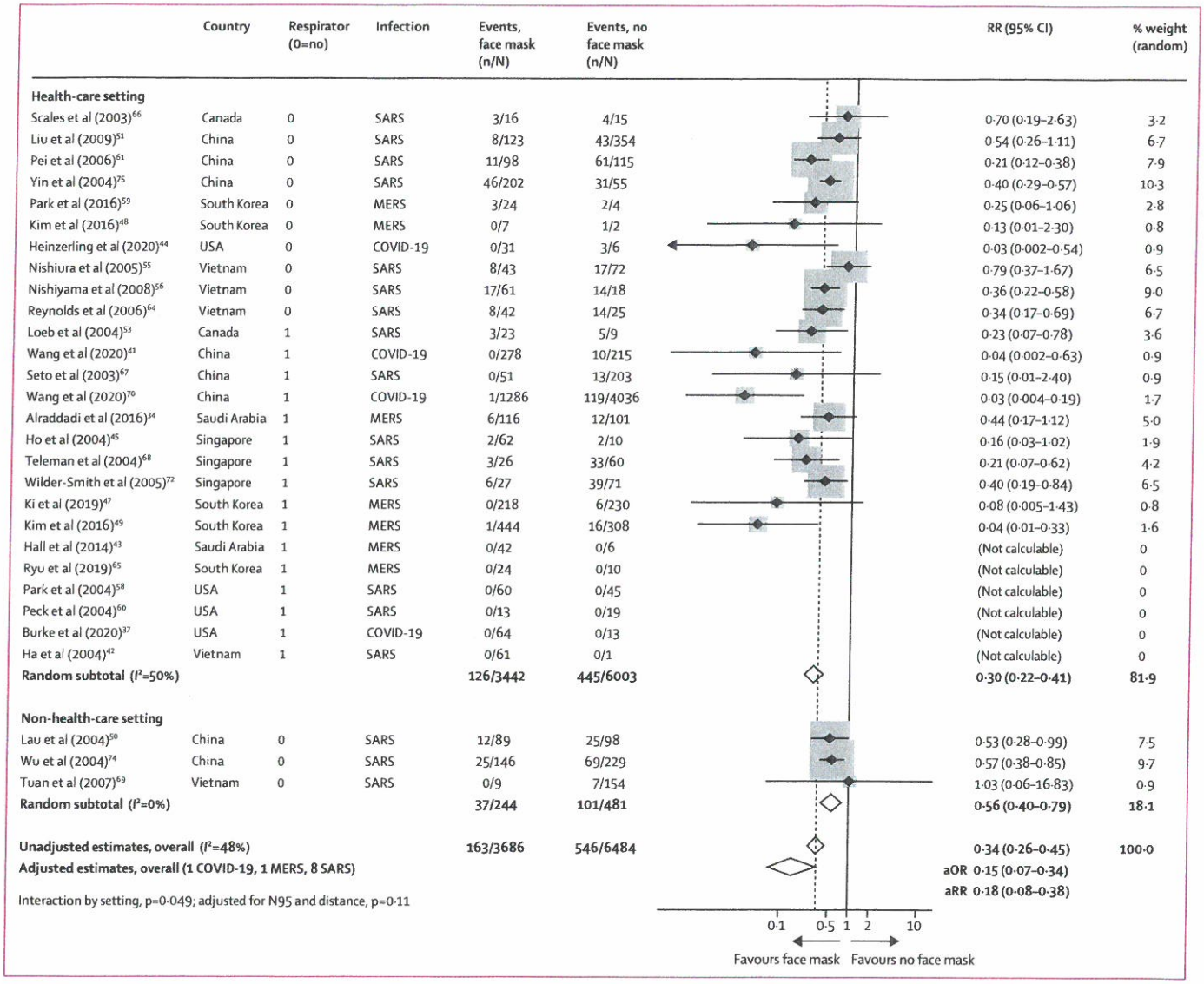


Figure 4: **Forest plot showing unadjusted estimates for the association of face mask use with viral infection causing COVID-19, SARS, or MERS**
SARS=severe acute respiratory syndrome. MERS=Middle East respiratory syndrome. RR=relative risk. aOR=adjusted odds ratio. aRR=adjusted relative risk.

respirators versus medical masks in randomised trials (OR 0·76, 95% CI 0·54–1·06)[13] with the effect-modification seen in this meta-analysis on COVID-19 (ratio of aORs 0·14, 95% CI 0·02–1·05) continued to support a stronger association of protection from COVID-19, SARS, or MERS with N95 or similar respirators versus other face masks (posterior probability for RR <1, 100% and 95%, respectively).

In 13 unadjusted studies and two adjusted studies,[34,37-39,47,49,51,54,58,60,61,65,75] eye protection was associated with lower risk of infection (unadjusted n=3713, RR 0·34, 95% CI 0·22 to 0·52; AR 5·5% with eye protection *vs* 16·0% with no eye protection, RD −10·6%, 95% CI −12·5 to −7·7; adjusted n=701, aOR 0·22, 95% CI 0·12 to 0·39; low certainty; figure 6; table 2; appendix pp 16–17).

Across 24 studies in health-care and non-health-care settings during the current pandemic of COVID-19, previous epidemics of SARS and MERS, or in general use, looking at contextual factors to consider in recommendations, most stakeholders found physical distancing and use of face masks and eye protection acceptable, feasible, and reassuring (appendix pp 20–22). However, challenges included frequent discomfort, high resource use linked with potentially decreased equity, less clear communication, and perceived reduced empathy of care providers by those they were caring for.

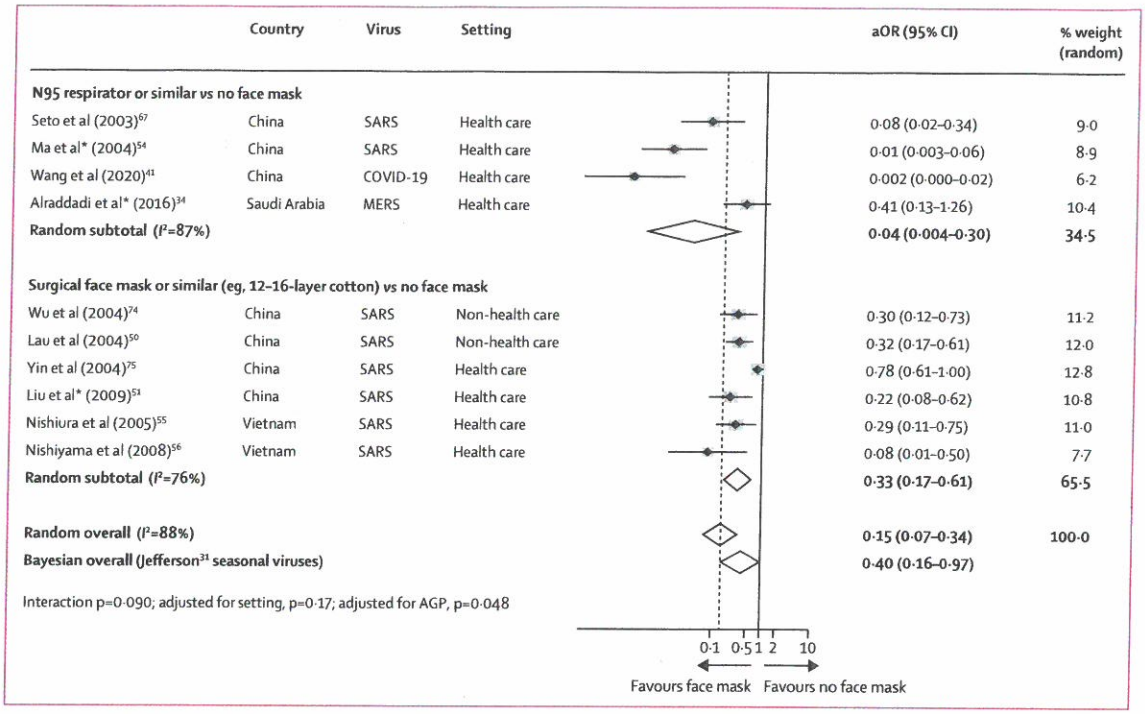


Figure 5: **Forest plot showing adjusted estimates for the association of face mask use with viral infection causing COVID-19, SARS, or MERS**
SARS=severe acute respiratory syndrome. MERS=Middle East respiratory syndrome. RR=relative risk. aOR=adjusted odds ratio. AGP=aerosol-generating procedures. *Studies clearly reporting AGP.

Discussion

The findings of this systematic review of 172 studies (44 comparative studies; n=25 697 patients) on COVID-19, SARS, and MERS provide the best available evidence that current policies of at least 1 m physical distancing are associated with a large reduction in infection, and distances of 2 m might be more effective. These data also suggest that wearing face masks protects people (both health-care workers and the general public) against infection by these coronaviruses, and that eye protection could confer additional benefit. However, none of these interventions afforded complete protection from infection, and their optimum role might need risk assessment and several contextual considerations. No randomised trials were identified for these interventions in COVID-19, SARS, or MERS.

Previous reviews are limited in that they either have not provided any evidence from COVID-19 or did not use direct evidence from other related emerging epidemic betacoronaviruses (eg, SARS and MERS) to inform the effects of interventions to curtail the current COVID-19 pandemic.[13,19,31,78] Previous data from randomised trials are mainly for common respiratory viruses such as seasonal influenza, with a systematic review concluding low certainty of evidence for extrapolating these findings to COVID-19.[13] Further, previous syntheses of available randomised controlled trials have not accounted for cluster effects in analyses, leading to substantial imprecision in treatment effect estimates. In between-study and within-study comparisons, we noted a larger effect of N95 or similar respirators compared with other masks. This finding is inconsistent with conclusions of a review of four randomised trials,[13] in which low certainty of evidence for no larger effect was suggested. However, in that review, the CIs were wide so a meaningful protective effect could not be excluded. We harmonised these findings with Bayesian approaches, using indirect data from randomised trials to inform posterior estimates. Despite this step, our findings continued to support the ideas not only that masks in general are associated with a large reduction in risk of infection from SARS-CoV-2, SARS-CoV, and MERS-CoV but also that N95 or similar respirators might be associated with a larger degree of protection from viral infection than disposable medical masks or reusable multilayer (12–16-layer) cotton masks. Nevertheless, in view of the limitations of these data, we did not rate the certainty of effect as high.[21] Our findings accord with those of a cluster randomised trial showing a potential benefit of continuous N95 respirator use over medical masks against seasonal viral infections.[79] Further high-quality research, including randomised trials of the optimum physical distance and the effectiveness of different types of masks in the general population and for health-care workers' protection, is urgently needed. Two trials are registered to better inform the optimum use of face masks for COVID-19 (NCT04296643 [n=576] and

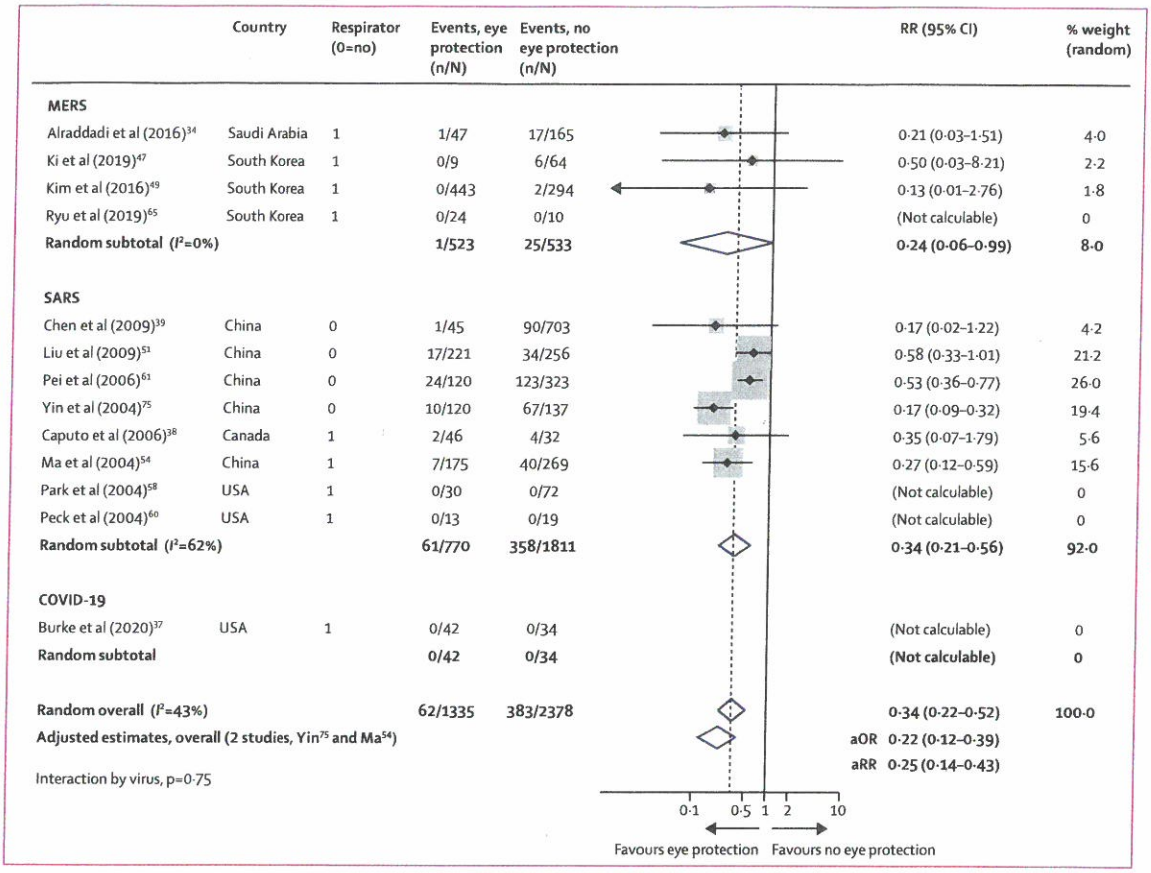


Figure 6: **Forest plot showing the association of eye protection with risk of COVID-19, SARS, or MERS transmission**
Forest plot shows unadjusted estimates. SARS=severe acute respiratory syndrome. MERS=Middle East respiratory syndrome. RR=relative risk. aOR=adjusted odds ratio. aRR=adjusted relative risk.

NCT04337541 [n=6000]). Until such data are available, our findings represent the current best estimates to inform face mask use to reduce infection from COVID-19. We recognise that there are strong, perhaps opposing, sentiments about policy making during outbreaks. In one viewpoint, the 2007 SARS Commission report stated:

> "...recognize, as an aspect of health worker safety, the precautionary principle that reasonable action to reduce risk, such as the use of a fitted N95 respirator, need not await scientific certainty".[80]

> "...if we do not learn from SARS and we do not make the government fix the problems that remain, we will pay a terrible price in the next pandemic".[81]

A counter viewpoint is that the scientific uncertainty and contextual considerations require a more nuanced approach. Although challenging, policy makers must carefully consider these two viewpoints along with our findings.

We found evidence of moderate certainty that current policies of at least 1 m physical distancing are probably associated with a large reduction in infection, and that distances of 2 m might be more effective, as implemented in some countries. We also provide estimates for 3 m. The main benefit of physical distancing measures is to prevent onward transmission and, thereby, reduce the adverse outcomes of SARS-CoV-2 infection. Hence, the results of our current review support the implementation of a policy of physical distancing of at least 1 m and, if feasible, 2 m or more. Our findings also provide robust estimates to inform models and contact tracing used to plan and strategise for pandemic response efforts at multiple levels.

The use of face masks was protective for both health-care workers and people in the community exposed to infection, with both the frequentist and Bayesian analyses lending support to face mask use irrespective of setting. Our unadjusted analyses might, at first impression, suggest use of face masks in the community setting to be less effective than in the health-care setting, but after accounting for differential N95 respirator use between health-care and non-health-care settings, we did not detect any striking differences in effectiveness of

face mask use between settings. The credibility of effect-modification across settings was, therefore, low. Wearing face masks was also acceptable and feasible. Policy makers at all levels should, therefore, strive to address equity implications for groups with currently limited access to face masks and eye protection. One concern is that face mask use en masse could divert supplies from people at highest risk for infection.[10] Health-care workers are increasingly being asked to ration and reuse PPE,[82,83] leading to calls for government-directed repurposing of manufacturing capacity to overcome mask shortages[84] and finding solutions for mask use by the general public.[84] In this respect, some of the masks studied in our review were reusable 12–16-layer cotton or gauze masks.[51,54,61,75] At the moment, although there is consensus that SARS-CoV-2 mainly spreads through large droplets and contact, debate continues about the role of aerosol,[2–8,85,86] but our meta-analysis provides evidence (albeit of low certainty) that respirators might have a stronger protective effect than surgical masks. Biological plausibility would be supported by data for aerosolised SARS-CoV-2[5–8] and preclinical data showing seasonal coronavirus RNA detection in fine aerosols during tidal breathing,[87] albeit, RNA detection does not necessarily imply replication and infection-competent virus. Nevertheless, our findings suggest it plausible that even in the absence of aerosolisation, respirators might be simply more effective than masks at preventing infection. At present, there is no data to support viable virus in the air outside of aerosol generating procedures from available hospital studies. Other factors such as super-spreading events, the subtype of health-care setting (eg, emergency room, intensive care unit, medical wards, dialysis centre), if aerosolising procedures are done, and environmental factors such as ventilation, might all affect the degree of protection afforded by personal protection strategies, but we did not identify robust data to inform these aspects.

Strengths of our review include adherence to full systematic review methods, which included artificial intelligence-supported dual screening of titles and abstracts, full-text evaluation, assessment of risk of bias, and no limitation by language. We included patients infected with SARS-CoV-2, SARS-CoV, or MERS-CoV and searched relevant data up to May 3, 2020. We followed the GRADE approach[16] to rate the certainty of evidence. Finally, we identified and appraise a large body of published work from China, from which much evidence emerged before the pandemic spread to other global regions.

The primary limitation of our study is that all studies were non-randomised, not always fully adjusted, and might suffer from recall and measurement bias (eg, direct contact in some studies might not be measuring near distance). However, unadjusted, adjusted, frequentist, and Bayesian meta-analyses all supported the main findings, and large or very large effects were recorded. Nevertheless, we are cautious not to be overly certain in the precise quantitative estimates of effects, although the qualitative effect and direction is probably of high certainty. Many studies did not provide information on precise distances, and direct contact was equated to 0 m distance; none of the eligible studies quantitatively evaluated whether distances of more than 2 m were more effective, although our meta-regression provides potential predictions for estimates of risk. Few studies assessed the effect of interventions in non-health-care settings, and they primarily evaluated mask use in households or contacts of cases, although beneficial associations were seen across settings. Furthermore, most evidence was from studies that reported on SARS and MERS (n=6674 patients with COVID-19, of 25 697 total), but data from these previous epidemics provide the most direct information for COVID-19 currently. We did not specifically assess the effect of duration of exposure on risk for transmission, although whether or not this variable was judged a risk factor considerably varied across studies, from any duration to a minimum of 1 h. Because of inconsistent reporting, information is limited about whether aerosol-generating procedures were in place in studies using respirators, and whether masks worn by infected patients might alter the effectiveness of each intervention, although the stronger association with N95 or similar respirators over other masks persisted when adjusting for studies reporting aerosol-generating medical procedures. These factors might account for some of the residual statistical heterogeneity seen for some outcomes, albeit I^2 is commonly inflated in meta-analyses of observational data,[21,22] and nevertheless the effects seen were large and probably clinically important in all adjusted studies.

Our comprehensive systematic review provides the best available information on three simple and common interventions to combat the immediate threat of COVID-19, while new evidence on pharmacological treatments, vaccines, and other personal protective strategies is being generated. Physical distancing of at least 1 m is strongly associated with protection, but distances of up to 2 m might be more effective. Although direct evidence is limited, the optimum use of face masks, in particular N95 or similar respirators in health-care settings and 12–16-layer cotton or surgical masks in the community, could depend on contextual factors; action is needed at all levels to address the paucity of better evidence. Eye protection might provide additional benefits. Globally collaborative and well conducted studies, including randomised trials, of different personal protective strategies are needed regardless of the challenges, but this systematic appraisal of currently best available evidence could be considered to inform interim guidance.

Contributors

DKC, EAA, SD, KS, SY, and HJS designed the study. SY, SD, KS, and HJS coordinated the study. SY and LH designed and ran the literature search. All authors acquired data, screened records, extracted data, and assessed risk of bias. DKC did statistical analyses. DKC and HJS wrote the report. All authors provided critical conceptual input, analysed and interpreted data, and critically revised the report.

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Declaration of interests
ML is an investigator of an ongoing clinical trial on medical masks versus N95 respirators for COVID-19 (NCT04296643). All other authors declare no competing interests.

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References

1 Worldometer. COVID-19 coronavirus pandemic. 2020. https://www.worldometers.info/coronavirus/ (accessed May 28, 2020).
2 Guo ZD, Wang ZY, Zhang SF, et al. Aerosol and surface distribution of severe acute respiratory syndrome coronavirus 2 in hospital wards, Wuhan, China, 2020. *Emerg Infect Dis* 2020; published online April 10. DOI:10.3201/eid2607.200885.
3 Chia PY, Coleman KK, Tan YK, et al. Detection of air and surface contamination by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in hospital rooms of infected patients. *medRxiv* 2020; published online April 9. DOI:10.1101/2020.03.29.20046557 (preprint).
4 Santarpia JL, Rivera DN, Herrera V, et al. Transmission potential of SARS-CoV-2 in viral shedding observed at the University of Nebraska Medical Center. *medRxiv* 2020; published online March 26. DOI:10.1101/2020.03.23.20039446 (preprint).
5 Cheng V, Wong S-C, Chen J, et al. Escalating infection control response to the rapidly evolving epidemiology of the coronavirus disease 2019 (COVID-19) due to SARS-CoV-2 in Hong Kong. *Infect Control Hosp Epidemiol* 2020; **41:** 493–98.
6 Wong SCY, Kwong RT-S, Wu TC, et al. Risk of nosocomial transmission of coronavirus disease 2019: an experience in a general ward setting in Hong Kong. *J Hosp Infect* 2020; **105:** 119–27.
7 Faridi S, Niazi S, Sadeghi K, et al. A field indoor air measurement of SARS-CoV-2 in the patient rooms of the largest hospital in Iran. *Sci Total Environ* 2020; **725:** 138401.
8 Ong SWX, Tan YK, Chia PY, et al. Air, surface environmental, and personal protective equipment contamination by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from a symptomatic patient. *JAMA* 2020; **323:** 1610–12.
9 Qualls N, Levitt A, Kanade N, et al. Community mitigation guidelines to prevent pandemic influenza: United States, 2017. *MMWR Recomm Rep* 2017; **66:** 1–34.
10 Feng S, Shen C, Xia N, Song W, Fan M, Cowling BJ. Rational use of face masks in the COVID-19 pandemic. *Lancet Respir Med* 2020; **8:** 434–36.
11 MacIntyre R, Chughtai A, Tham CD, Seale H. COVID-19: should cloth masks be used by healthcare workers as a last resort? April 9, 2020. https://blogs.bmj.com/bmj/2020/04/09/covid-19-should-cloth-masks-be-used-by-healthcare-workers-as-a-last-resort/ (accessed May 12, 2020).
12 Loeb M, Dafoe N, Mahony J, et al. Surgical mask *vs* N95 respirator for preventing influenza among health care workers: a randomized trial. *JAMA* 2009; **302:** 1865–71.
13 Bartoszko JJ, Farooqi MAM, Alhazzani W, Loeb M. Medical masks vs N95 respirators for preventing COVID-19 in healthcare workers: a systematic review and meta-analysis of randomized trials. *Influenza Other Respir Viruses* 2020; published online April 4. DOI:10.1111/irv.12745.
14 Schünemann HJ, Moja L. Reviews: rapid! Rapid! Rapid! . . . and systematic. *Syst Rev* 2015; **4:** 4.
15 Cochrane Training. Cochrane handbook for systematic reviews of interventions, version 6. 2019. https://training.cochrane.org/handbook/current (accessed May 12, 2020).
16 Guyatt GH, Oxman AD, Vist GE, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ* 2008; **336:** 924–26.
17 Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *J Clin Epidemiol* 2009; **62:** 1006–12.
18 Stroup DF, Berlin JA, Morton SC, et al. Meta-analysis of observational studies in epidemiology: a proposal for reporting. *JAMA* 2000; **283:** 2008–12.
19 Jefferson T, Del Mar CB, Dooley L, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses. *Cochrane Database Syst Rev* 2011; **7:** CD006207.
20 Offeddu V, Yung CF, Low MSF, Tam CC. Effectiveness of masks and respirators against respiratory infections in healthcare workers: a systematic review and meta-analysis. *Clin Infect Dis* 2017; **65:** 1934–42.
21 Guyatt GH, Oxman AD, Kunz R, et al. GRADE guidelines, 7: rating the quality of evidence—inconsistency. *J Clin Epidemiol* 2011; **64:** 1294–302.
22 Iorio A, Spencer FA, Falavigna M, et al. Use of GRADE for assessment of evidence about prognosis: rating confidence in estimates of event rates in broad categories of patients. *BMJ* 2015; **350:** h870.
23 Moskalewicz A, Oremus M. No clear choice between Newcastle-Ottawa Scale and Appraisal Tool for Cross-Sectional Studies to assess methodological quality in cross-sectional studies of health-related quality of life and breast cancer. *J Clin Epidemiol* 2020; **120:** 94–103.
24 Wells GA, Shea B, O'Connell D, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. 2019. http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp (accessed May 12, 2020).
25 Sterne JAC, Savović J, Page MJ, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. *BMJ* 2019; **366:** l4898.
26 Guyatt G, Oxman AD, Akl EA, et al. GRADE guidelines, 1: introduction—GRADE evidence profiles and summary of findings tables. *J Clin Epidemiol* 2011; **64:** 383–94.
27 Guyatt GH, Thorlund K, Oxman AD, et al. GRADE guidelines, 13: preparing summary of findings tables and evidence profiles—continuous outcomes. *J Clin Epidemiol* 2013; **66:** 173–83.
28 Santesso N, Carrasco-Labra A, Langendam M, et al. Improving GRADE evidence tables part 3: detailed guidance for explanatory footnotes supports creating and understanding GRADE certainty in the evidence judgments. *J Clin Epidemiol* 2016; **74:** 28–39.
29 Santesso N, Glenton C, Dahm P, et al. GRADE guidelines, 26: informative statements to communicate the findings of systematic reviews of interventions. *J Clin Epidemiol* 2020; **119:** 126–35.

30 Higgins JP, Thompson SG. Controlling the risk of spurious findings from meta-regression. *Stat Med* 2004; **23:** 1663–82.

31 Jefferson T, Jones M, Al Ansari LA, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses, part 1: face masks, eye protection and person distancing—systematic review and meta-analysis. *medRxiv* 2020; published online April 7. DOI:10.1101/2020.03.30.20047217 (preprint).

32 Sutton AJ, Abrams KR. Bayesian methods in meta-analysis and evidence synthesis. *Stat Methods Med Res* 2001; **10:** 277–303.

33 Goligher EC, Tomlinson G, Hajage D, et al. Extracorporeal membrane oxygenation for severe acute respiratory distress syndrome and posterior probability of mortality benefit in a post hoc Bayesian analysis of a randomized clinical trial. *JAMA* 2018; **320:** 2251–59.

34 Alraddadi BM, Al-Salmi HS, Jacobs-Slifka K, et al. Risk factors for Middle East respiratory syndrome coronavirus infection among healthcare personnel. *Emerg Infect Dis* 2016; **22:** 1915–20.

35 Arwady MA, Alraddadi B, Basler C, et al. Middle East respiratory syndrome coronavirus transmission in extended family, Saudi Arabia, 2014. *Emerg Infect Dis* 2016; **22:** 1395–402.

36 Bai Y, Wang X, Huang Q, et al. SARS-CoV-2 infection in health care workers: a retrospective analysis and a model study. *medRxiv* 2020; published online April 1. DOI:10.1101/2020.03.29.20047159 (preprint).

37 Burke RM, Balter S, Barnes E, et al. Enhanced contact investigations for nine early travel-related cases of SARS-CoV-2 in the United States. *medRxiv* 2020; published online May 3. DOI:10.1101/2020.04.27.20081901 (preprint).

38 Caputo KM, Byrick R, Chapman MG, Orser BJ, Orser BA. Intubation of SARS patients: infection and perspectives of healthcare workers. *Can J Anaesth* 2006; **53:** 122–29.

39 Chen WQ, Ling WH, Lu CY, et al. Which preventive measures might protect health care workers from SARS? *BMC Public Health* 2009; **9:** 81.

40 Cheng H-Y, Jian S-W, Liu D-P, Ng T-C, Huang W-T, Lin H-H. High transmissibility of COVID-19 near symptom onset. *medRxiv* 2020; published online March 19. DOI:10.1101/2020.03.18.20034561 (preprint).

41 Wang X, Pan Z, Cheng Z. Association between 2019-nCoV transmission and N95 respirator use. *J Hosp Infect* 2020; **105:** 104–05.

42 Ha LD, Bloom SA, Hien NQ, et al. Lack of SARS transmission among public hospital workers, Vietnam. *Emerg Infect Dis* 2004; **10:** 265–68.

43 Hall AJ, Tokars JI, Badreddine SA, et al. Health care worker contact with MERS patient, Saudi Arabia. *Emerg Infect Dis* 2014; **20:** 2148–51.

44 Heinzerling A, Stuckey MJ, Scheuer T, et al. Transmission of COVID-19 to health care personnel during exposures to a hospitalized patient: Solano County, California, February 2020. *MMWR Morb Mortal Wkly Rep* 2020; **69:** 472–76.

45 Ho KY, Singh KS, Habib AG, et al. Mild illness associated with severe acute respiratory syndrome coronavirus infection: lessons from a prospective seroepidemiologic study of health-care workers in a teaching hospital in Singapore. *J Infect Dis* 2004; **189:** 642–47.

46 Van Kerkhove MD, Alaswad S, Assiri A, et al. Transmissibility of MERS-CoV infection in closed setting, Riyadh, Saudi Arabia, 2015. *Emerg Infect Dis J* 2019; **25:** 1802–09.

47 Ki HK, Han SK, Son JS, Park SO. Risk of transmission via medical employees and importance of routine infection-prevention policy in a nosocomial outbreak of Middle East respiratory syndrome (MERS): a descriptive analysis from a tertiary care hospital in South Korea. *BMC Pulm Med* 2019; **19:** 190.

48 Kim T, Jung J, Kim SM, et al. Transmission among healthcare worker contacts with a Middle East respiratory syndrome patient in a single Korean centre. *Clin Microbiol Infect* 2016; **22:** e11–13.

49 Kim CJ, Choi WS, Jung Y, et al. Surveillance of the Middle East respiratory syndrome (MERS) coronavirus (CoV) infection in healthcare workers after contact with confirmed MERS patients: incidence and risk factors of MERS-CoV seropositivity. *Clin Microbiol Infect* 2016; **22:** 880–86.

50 Lau JTF, Lau M, Kim JH, Tsui HY, Tsang T, Wong TW. Probable secondary infections in households of SARS patients in Hong Kong. *Emerg Infect Dis* 2004; **10:** 235–43.

51 Liu W, Tang F, Fang LQ, et al. Risk factors for SARS infection among hospital healthcare workers in Beijing: a case control study. *Trop Med Int Health* 2009; **14** (suppl 1): 52–59.

52 Liu ZQ, Ye Y, Zhang H, Guohong X, Yang J, Wang JL. Analysis of the spatio-temporal characteristics and transmission path of COVID-19 cluster cases in Zhuhai. *Trop Geogr* 2020; published online March 12. DOI:10.13284/j.cnki.rddl.003228.

53 Loeb M, McGeer A, Henry B, et al. SARS among critical care nurses, Toronto. *Emerg Infect Dis* 2004; **10:** 251–55.

54 Ma HJ, Wang HW, Fang LQ, et al. A case-control study on the risk factors of severe acute respiratory syndromes among health care workers. *Zhonghua Liu Xing Bing Xue Za Zhi* 2004; **25:** 741–44 (in Chinese).

55 Nishiura H, Kuratsuji T, Quy T, et al. Rapid awareness and transmission of severe acute respiratory syndrome in Hanoi French Hospital, Vietnam. *Am J Trop Med Hyg* 2005; **73:** 17–25.

56 Nishiyama A, Wakasugi N, Kirikae T, et al. Risk factors for SARS infection within hospitals in Hanoi, Vietnam. *Jpn J Infect Dis* 2008; **61:** 388–90.

57 Olsen SJ, Chang HL, Cheung TY, et al. Transmission of the severe acute respiratory syndrome on aircraft. *N Engl J Med* 2003; **349:** 2416–22.

58 Park BJ, Peck AJ, Kuehnert MJ, et al. Lack of SARS transmission among healthcare workers, United States. *Emerg Infect Dis* 2004; **10:** 244–48.

59 Park JY, Kim BJ, Chung KH, Hwang YI. Factors associated with transmission of Middle East respiratory syndrome among Korean healthcare workers: infection control via extended healthcare contact management in a secondary outbreak hospital. *Respirology* 2016; **21** (suppl 3): 89 (abstr APSR6-0642).

60 Peck AJ, Newbern EC, Feikin DR, et al. Lack of SARS transmission and U.S. SARS case-patient. *Emerg Infect Dis* 2004; **10:** 217–24.

61 Pei LY, Gao ZC, Yang Z, et al. Investigation of the influencing factors on severe acute respiratory syndrome among health care workers. *Beijing Da Xue Xue Bao Yi Xue Ban* 2006; **38:** 271–75.

62 Rea E, Laflèche J, Stalker S, et al. Duration and distance of exposure are important predictors of transmission among community contacts of Ontario SARS cases. *Epidemiol Infect* 2007; **135:** 914–21.

63 Reuss A, Litterst A, Drosten C, et al. Contact investigation for imported case of Middle East respiratory syndrome, Germany. *Emerg Infect Dis* 2014; **20:** 620–25.

64 Reynolds MG, Anh BH, Thu VH, et al. Factors associated with nosocomial SARS-CoV transmission among healthcare workers in Hanoi, Vietnam, 2003. *BMC Public Health* 2006; **6:** 207.

65 Ryu B, Cho SI, Oh MD, et al. Seroprevalence of Middle East respiratory syndrome coronavirus (MERS-CoV) in public health workers responding to a MERS outbreak in Seoul, Republic of Korea, in 2015. *Western Pac Surveill Response J* 2019; **10:** 46–48.

66 Scales DC, Green K, Chan AK, et al. Illness in intensive care staff after brief exposure to severe acute respiratory syndrome. *Emerg Infect Dis* 2003; **9:** 1205–10.

67 Seto WH, Tsang D, Yung RWH, et al. Effectiveness of precautions against droplets and contact in prevention of nosocomial transmission of severe acute respiratory syndrome (SARS). *Lancet* 2003; **361:** 1519–20.

68 Teleman MD, Boudville IC, Heng BH, Zhu D, Leo YS. Factors associated with transmission of severe acute respiratory syndrome among health-care workers in Singapore. *Epidemiol Infect* 2004; **132:** 797–803.

69 Tuan PA, Horby P, Dinh PN, et al. SARS transmission in Vietnam outside of the health-care setting. *Epidemiol Infect* 2007; **135:** 392–401.

70 Wang Q, Huang X, Bai Y, et al. Epidemiological characteristics of COVID-19 in medical staff members of neurosurgery departments in Hubei province: a multicentre descriptive study. *medRxiv* 2020; published online April 24. DOI:10.1101/2020.04.20.20064899 (preprint).

71 Wiboonchutikul S, Manosuthi W, Likanonsakul S, et al. Lack of transmission among healthcare workers in contact with a case of Middle East respiratory syndrome coronavirus infection in Thailand. *Antimicrob Resist Infect Control* 2016; **5:** 21.

72 Wilder-Smith A, Teleman MD, Heng BH, Earnest A, Ling AE, Leo YS. Asymptomatic SARS coronavirus infection among healthcare workers, Singapore. *Emerg Infect Dis* 2005; **11:** 1142–45.

73 Wong TW, Lee CK, Tam W, et al. Cluster of SARS among medical students exposed to single patient, Hong Kong. *Emerg Infect Dis* 2004; **10:** 269–76.

74 Wu J, Xu F, Zhou W, et al. Risk factors for SARS among persons without known contact with SARS patients, Beijing, China. *Emerg Infect Dis* 2004; **10:** 210–16.

75 Yin WW, Gao LD, Lin WS, et al. Effectiveness of personal protective measures in prevention of nosocomial transmission of severe acute respiratory syndrome. *Zhonghua Liu Xing Bing Xue Za Zhi* 2004; **25:** 18–22.

76 Yu ITS, Wong TW, Chiu YL, Lee N, Li Y. Temporal-spatial analysis of severe acute respiratory syndrome among hospital inpatients. *Clin Infect Dis* 2005; **40:** 1237–43.

77 Yu IT, Xie ZH, Tsoi KK, et al. Why did outbreaks of severe acute respiratory syndrome occur in some hospital wards but not in others? *Clin Infect Dis* 2007; **44:** 1017–25.

78 Verbeek JH, Rajamaki B, Ijaz S, et al. Personal protective equipment for preventing highly infectious diseases due to exposure to contaminated body fluids in healthcare staff. *Cochrane Database Syst Rev* 2019; **7:** CD011621.

79 MacIntyre CR, Wang Q, Seale H, et al. A randomized clinical trial of three options for N95 respirators and medical masks in health workers. *Am J Respir Crit Care Med* 2013; **187:** 960–66.

80 Campbell A. Chapter eight: it's not about the mask: SARS Commission final report, volume 3. December, 2006. http://www.archives.gov.on.ca/en/e_records/sars/report/v3-pdf/Vol3Chp8.pdf (accessed May 12, 2020).

81 Webster P. Ontario issues final SARS Commission report. *Lancet* 2007; **369:** 264.

82 Rimmer A. COVID-19: experts question guidance to reuse PPE. *BMJ* 2020; **369:** m1577.

83 Mackenzie D. Reuse of N95 masks. *Engineering* 2020; published online April 13. DOI:10.1016/j.eng.2020.04.003.

84 Greenhalgh T, Schmid MB, Czypionka T, Bassler D, Gruer L. Face masks for the public during the covid-19 crisis. *BMJ* 2020; **369:** m1435.

85 Bahl P, Doolan C, de Silva C, Chughtai AA, Bourouiba L, MacIntyre CR. Airborne or droplet precautions for health workers treating coronavirus disease 2019? *J Infect Dis* 2020; published online April 16. DOI:10.1093/infdis/jiaa189.

86 Schünemann HJ, Khabsa J, Solo K, et al. Ventilation techniques and risk for transmission of coronavirus disease, including COVID-19: a living systematic review of multiple streams of evidence. *Ann Intern Med* 2020; published online May 22. DOI:10.7326/M20-2306.

87 Leung NHL, Chu DKW, Shiu EYC, et al. Respiratory virus shedding in exhaled breath and efficacy of face masks. *Nat Med* 2020; **26:** 676–80.

Appendix D

LOWELL PUBLIC SCHOOLS
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MEMORANDUM

To:	Jim Hall, Chief Operating Officer
From:	John Descoteaux, Transportation Director
Date:	March 10, 2021
Ref:	April 5, 2021 Transportation Update

In anticipation of students in grades Kindergarten through Five (5) returning to school for in-person learning on April 5, 2021, the Transportation Department is examining certain factors to ensure a safe transportation environment for our students. In addition to safety, the department assessed the possibility of reducing the 2-mile distance requirement for students to access transportation established due to Covid-19 restrictions.

Presently, the Lowell Public Schools is transporting approximately one thousand students in grades one through six who reside two (2) miles or more from their home to school utilizing thirty-five (35) school buses. Based on routing software data, it is anticipated that an additional one thousand student students could be transported beginning April 5, 2021 utilizing the 35 school buses.

The Transportation Department has reviewed the change in DESE guidance and its potential impact on busing and the risks associated with change. On February 11, 2021, the Department of Elementary and Secondary Education (DESE) issued a memo updating the

physical distance guidelines on school buses. The memo states:

> *"In all cases, maximum distance between students should be maintained during boarding and transportation. Capacity limitations and physical distancing requirements for students on buses are **lifted**. Keep windows open at all times during operation at least two inches. Students should be assigned to a single bus and a particular seat. This will limit potential exposure and make contact tracing easier to conduct."*

Based upon this updated guidance from DESE, the Transportation Department estimates that 52 middle school and 77 elementary students would be able to be transported on each individual bus to-and-from their respective schools.

There are significant impediments and risks to this contemplated change. Frequent discussions have occurred with North Reading Transportation (NRT) regarding it providing the additional fifteen (15) school buses to meet the current contract requirement of providing fifty (50) school buses which will allow LPS to potentially reduce the Covid-19 mileage increase. NRT expressed trepidation regarding a shortage of available bus drivers for the remainder of the school year. Furthermore, every community and charter school in the area is recruiting drivers and other school workers, which is impacting supply, in addition to the relative competitiveness of unemployment benefits which do not expose a driver/monitor to as much health risk. Further factors impacting this shortage include availability of vaccines, not all drivers meet the eligibility for current inoculation, reduction in applicant pool due to lack of consistent employment throughout the pandemic, and the high demographic of school bus drivers who are retirees and have chosen to forego this employment during the pandemic. In addition to risk associated with the stability of the driver workforce, there are additional risks to the continuity of education. With more children taking away from walking to school or getting driven in a car to school, increased numbers of children on buses increases risk to drivers and monitors. A positive test for a driver or monitor results in dozens of p students and multiple schools in quarantine. The amount quarantining will be further multiplied with 52 or 77 students on a bus, versus when we have a student in every other seat.

Furthermore, to accurately assess a reduction in the mileage and increase access to transportation for students returning to in-person learning, additional school and student data needs to be made available. Mileage calculations are based upon student residence and/or alternative addresses to their assigned school. Due to a lack of full information, I have made calculations based solely on a percentage of students in a school who will be returning. This will cause inaccuracies and jeopardize efficient routing and possible omission of transporting additional students, particularly since past percentages of utilization are not a reliable indicator of expected use in this unique pandemic situation. With confirmed data, a more thorough analysis can be completed to reflect the district's ability to return to prior years mileage requirements and support students safe return to school.

Recommendation:

After weighing the risks and benefits of expanding transportation, I recommend no adjustment to the current policy in effect for the 2020/2021 school year. For the time being, I recommend that we maintain the temporary busing policy of transporting those in Grades 1-6 who live 2 or miles away from their schools. It may be possible, after studying the capacity levels and resulting routes in existence at the end of April, to expand busing in May, but such is not recommended at this time given the current number of operational buses and the forecasted expansion of riders on April 5, 2021 due to the already scheduled expansion of in-person learning.

Appendix E

Appendix E

LPS Elementary Schools Kitchens

MAINTAINING SAFE ENVIRONMENTS Many of our kitchens have been out of operation for an extended period. It's critical that a thorough facility review is completed so our associates, students, and guests can return to a safe and operational environment. We will be completing benchmark safety audits prior to reopening and then regularly thereafter.

To keep our employees safe and healthy in conjunction with creating a safe environment for everyone we serve, we are adapting our service styles to adjust for social distancing and other safety practices including menu modifications and service area adjustments.

FOCUSING ON STUDENTS: A series of new communications were developed to welcome students back to school and encourage safe integration back into school life. These materials have been designed for elementary and secondary students.

Sample Menu Items (all in pre-packaged bags):

- Cereal, breakfast sandwiches, muffins, and fruit
- Salad, sandwiches, sides, and bento boxes
- Hot Meals served 2 days per week until full staffing is in place

ENGAGING EMPLOYEES: When our teams return to the workplace, we must ensure we train them on new safety practices. These trainings include guidance on increased sanitation measures, proper PPE guidance, and more. Our SAFE Briefs shared during daily Safety Huddles focus on specific safety topics to educate our teams each week.

COMMUNICATION: We will launch a series of communication pieces that focuses on our reopening strategies that share our new operations processes, FAQs, Menus and other solutions to continue to engage students and the school community.

Currently open	Schedule for remainder of openings for K-8 kitchens.
Kitchens: Elementary open: • Pyne • McAvinnue • Morey School • Lincoln School • STEM Academy **Middle/High** • LHS production kitchen: • Butler School • Wang School • Robinson School	**Kitchens:** **Opening 3/15/2021** • Bartlett Community Partnership • Greenhalge Elementary School • Murkland Elementary School **Opening 3/22/2021** • Pawtucketville Elementary • Reilly Elementary • McAuliffe Elementary **Opening 3/29/2021** • Shaughnessy Elementary School • Baily Elementary School

STAFFING

- Currently, all 40 hours and 35 hours have been reinstated. We are also moving all cooks to their original elementary school as their school opens.
- **Openings:**
  - Cook openings at Morey, McAuliffe, Lincoln, LHS.
- Staffing Roster will be determined by
  - Level of service will be dependent on number of students in building and lunch service style.
  - Service style will be dependent on staffing available.
- Currently working with HR to place all staff and hire new staff to fill vacancies.
- Recommend shifting remote meal service from 5 days per week to 3 days per week at Morey, Robinson, Butler, Wang. Continue 3 day per week service at LHS, Murkland, Lincoln, Greenhalge, Stoklosa. Keep Stem Academy daily service.